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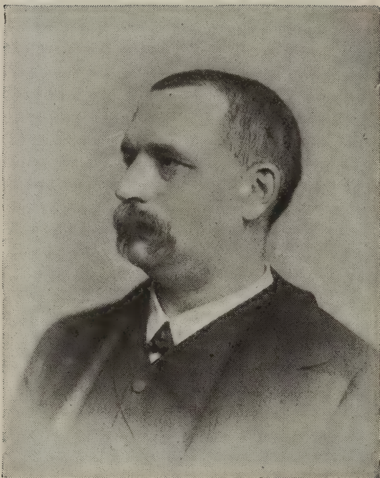

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LIST OF MEMBERS.

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1890. Stillé, Alfred, 3900 Spruce Street, Philadelphia.
1897. Weber, Hermann, 10 Grosvenor Street, W., London, England.
1897. Williams, Charles Theodore, 2 Upper Brook Street, W., London.

Corresponding Members.

1898. Eyre, G. G., Claremont, Cape Town, South Africa.
1898. Gache, Samuel, 729 Corrientes Street, Buenos Ayres, S. A.
1898. Licéaga, Eduardo, 4 San Andres Street, Mexico.
1898. Orvañanos, Domingo, 25 Chavarria Street, Mexico.
1898. Ruedi, Carl, Arosa, Switzerland.
1898. Sunderland, Septimus, 11 Cavendish Place, W., London.
1898. Wragge, Clement L., Brisbane, Queensland, Australia.

Active Members.

1893. Abbott, A. C., Laboratory of Hygiene, Univ. of Penna., Philadelphia.
1888. Abbot, Griffith E., 13½ Street and Pennsylvania Avenue, Washington, D. C.
1897. Alden, C. H., Assistant Surgeon-General, U. S. A., Washington, D. C.
1897. Alton, Charles D., 86 Farmington Avenue, Hartford, Conn.
1898. Anders, Howard S., 1836 Wallace Street, Philadelphia.
1889. Anders, J. M., 1605 Walnut Street, Philadelphia.
1890. Anderson, B. P., Colorado Springs, Col.
1890. Atkins, Francis H., East Las Vegas, N. M.

ELECTED

1893. Babcock, R. H., 103 State Street, Chicago.
1885. Baker, Henry B., 726 Ottawa Street, Lansing, Mich.
1898. Baldwin, Edward R., Saranac Lake, N. Y.
1898. Battle, S. Westray, Asheville, N. C.
1885. Bell, A. N., 337 Clinton Street, Brooklyn.
1896. Bergey, David H., Laboratory of Hygiene, Univ. of Penna., Philadelphia.
1896. Bernardy, E. P., 221 South 17th Street, Philadelphia.
1897. Billings, Frank, 100 State Street, Chicago.
1897. Blackader, Alexander D., 236 Mountain Street, Montreal, Canada.
1895. Boardman, W. S., 57 Hancock Street, Boston.
1897. Bonney, S. G., 726 14th Street, Denver.
1884. Bosworth, F. H., 26 West 46th Street, New York.
1885. Bowditch, V. Y., 506 Beacon Street, Boston.
1895. Brandt, C. N., Hot Springs, Va.
1891. Brannan, John W., 11 W. 12th Street, New York.
1894. Bridge, Norman, 217 South Broadway, Los Angeles, Cal.
1898. Brower, D. R., 34 Washington Street, Chicago.
1897. Brown, Sanger, Reliance Building, Chicago.
1890. Buckley, J. J., Missoula, Mont.
1896. Bulette, W. W., Central Block, Pueblo, Col.
1898. Bulkley, L. D., 4 East 37th Street, New York.
1886. Butler, G. R., 229 Gates Avenue, Brooklyn.

1896. Campbell, W. A., 38 Bank Building, Colorado Springs.
1898. Casselberry, W. E., 103 State Street, Chicago.
1894. Chapin, Frederick W., Hot Springs, Va.
1887. Chapman, S. H., New Haven, Conn.
1898. Chappell, Walter F., 7 East 55th Street, New York.
1898. Cleemann, Richard A., 2135 Spruce Street, Philadelphia.
1894. Coleman, Thomas D., 563 Green Street, Augusta, Ga.
1889. Coolidge, A., Jr., 613 Beacon Street, Boston.
1885. Curtin, R. G., 22 South 18th Street, Philadelphia.

1892. Daland, Judson, 319 South 18th Street, Philadelphia.
1885. Daly, W. H., 516 Market Street, Pittsburg, Pa.
1897. Danforth, I. N., 70 State Street, Chicago.

ELECTED

1890. Darlington, Thomas, Jr., King's Bridge, New York City.
1897. Davis, N. S., Jr., 65 Randolph Street, Chicago.
1884. Denison, Charles, 823 14th Street, Denver.
1897. De Witt, Calvin, Surgeon U. S. A., Fortress Monroe.
1884. Didama, H. D., 424 South Salina Street, Syracuse, N. Y.
1890. Dodge, H. O., Boulder, Colorado.
1898. Dudley, E. C., 1619 Indiana Avenue, Chicago.
1896. Dudley, Wm. F., 147 Clinton Street, Brooklyn.

1897. Edson, Carroll E., McPhee Building, Denver, Col.
1892. Elsner, H. L., Fayette Park, Syracuse, N. Y.
1885. Eskridge, J. T., 204 Equitable Building, Denver, Col.

1887. Fisk, Samuel A., 37 18th Street, Denver, Col.
1885. Ford, Willis E., 266 Genesee Street, Utica, N. Y.
1885. French, Thomas R., 469 Clinton Avenue, Brooklyn.
1897. Fütterer, Gustav, 34 Washington Street, Chicago.

1896. Gardiner, C. F., 224 Pike's Peak Avenue, Colorado Springs, Col.
1884. Garland, George M., 227 Newberry Street, Boston.
1886. Garnett, A. S., Hot Springs, Ark.
1898. Getchell, Albert C., 6 Linden Street, Worcester, Mass.
1892. Gibson, William M., 260 Genesee Street, Utica, N. Y.
1884. Glasgow, W. C., 2847 Washington Avenue, St. Louis.
1893. Gray, Landon Carter, 6 East 49th Street, New York.

1893. Hance, I. H., Lakewood, N. J.
1896. Hare, Hobart A., 222 South 15th Street, Philadelphia.
1891. Hart, James A., Colorado Springs, Col.
1896. Heffron, John L., 528 South Salina Street, Syracuse, N. Y.
1893. Hinsdale, Guy, 3943 Chestnut Street, Philadelphia.
1885. Hopkins, Thomas S., Thomasville, Ga.
1897. Hyde, James Nevins, 34 Washington Street, Chicago.

1884. Ingals, E. Fletcher, 34 Washington Street, Chicago.

ELECTED

1889. Jacobi, A., 110 West 34th Street, New York.
1888. Jayne, W. A., 217 McPhee Building, Denver, Col.
1897. Johnson, Frank S., 2521 Prairie Avenue, Chicago.
1886. Johnston, W. W., 1603 K Street, N. W., Washington, D. C.
1893. Judd, L. D., 3603 Powelton Avenue, Philadelphia.

1890. Kellogg, J. H., Battle Creek, Mich.
1884. Knight, Frederick I., 195 Beacon Street, Boston.

1887. Langmaid, S. W., 373 Boylston Street, Boston.
1890. Lincoln, R. P., 32 West 31st Street, New York.
1896. Loomis, Henry P., 58 East 34th Street, New York.

1894. McGahan, C. F., Aiken, S. C., and Bethlehem, N. H.
1887. Mays, Thomas J., 1829 Spruce Street, Philadelphia.
1898. Merrick, Samuel K., 843 N. Eutaw Street, Baltimore.
1891. Moore, H. B., Colorado Springs, Col.
1890. Mulhall, J. C., 3561 Olive Street, St. Louis.
1889. Munro, John C., 173 Beacon Street, Boston.
1886. Musser, John H., 1927 Chestnut Street, Philadelphia.

1895. Newton, R. C., 42 Church Street, Montclair, N. J.
1888. Nunn, Richard J., 119 York Street, Savannah.

1884. Orme, S. H., Box 1045, Los Angeles, Cal.
1888. Otis, E. O., 308 Commonwealth Avenue, Boston.

1887. Peale, A. C., 605 12th Street, N. W., Washington, D. C.
1893. Peterson, Frederick, 60 West 50th Street, New York.
1895. Phillips, W. F. R., Weather Bureau, Washington, D. C.
1885. Platt, Isaac Hull, 30 West 71st Street, New York.
1887. Platt, Walter B., 802 Cathedral Street, Baltimore.

1891. Quimby, Charles E., 44 West 36th Street, New York.

1891. Ransom, C. C., 152 West 48th Street, New York (Richfield Springs).
1884. Reed, Boardman, 1928 Chestnut Street, Philadelphia.

ELECTED

1885. Rice, C. C., 123 East 19th Street, New York.
1893. Risley, S. D., 1722 Walnut Street, Philadelphia.
1884. Robinson, Beverley, 42 West 37th Street, New York.
1890. Robinson, W. D., 2012 Mt. Vernon Street, Philadelphia.
1896. Rodgers, Mark A., Tucson, Arizona.
1892. Roe, John O., 28 North Clinton Street, Rochester, N. Y.
1890. Rogers, E. J. A., 222 Colfax Avenue, Denver, Col.
1889. Ruck, Carl von, Asheville, N. C.

1884. Schauffler, E. W., 1221 Washington Street, Kansas City, Mo.
1896. Schroeder, Henry H., 230 West 135th Street, New York City.
1884. Shurly, E. L., 32 Adams Avenue, West Detroit, Mich.
1890. Smith, A. Alexander, 8 West 47th Street, New York.
1885. Smith, Andrew H., 18 East 46th Street, New York.
1887. Smith, Frank Fremont, St. Augustine, Fla., and Bar Harbor, Maine.
1887. Solly, S. E., 2 North Cascade Avenue, Colorado Springs, Colorado.

1892. Taylor, H. Longstreet, 75 Lowry Arcade, St. Paul, Minn.
1896. Taylor, J. Madison, 1504 Pine Street, Philadelphia.
1885. Trudeau, E. L., Saranac Lake, New York.
1884. Tyndale, J. Hilgard, 13th and P Streets, Lincoln, Nebraska.
1898. Tyson, James, 1506 Spruce Street, Philadelphia.

1884. Walker, James B., 1617 Green Street, Philadelphia.
1891. Watson, E. W., 131 North 20th Street, Philadelphia.
1895. Weber, Leonard, 25 West 46th Street, New York.
1897. Whitcomb, H. H., Norristown, Pa.
1898. Whitney, Herbert B., 726 14th Street, Denver, Col.
1898. Williams, Francis H., 505 Beacon Street, Boston.
1898. Williams, Harold, 528 Beacon Street, Boston.
1885. Williams, H. F., 197 Gates Avenue, Brooklyn.
1884. Wilson, James C., 1437 Walnut Street, Philadelphia.

Total, 130 active members.

MINUTES.

The Fifteenth Annual Session of the Association was called to order at Maplewood, New Hampshire, on August 31, 1898, by the President, Dr. E. O. Otis, of Boston.

The following members were present at the session :

Dr. E. R. Baldwin, Saranac Lake.
Dr. A. D. Blackader, Montreal.
Dr. V. Y. Bowditch, Boston.
Dr. G. R. Butler, Brooklyn.
Dr. Walter F. Chappell, New York.
Dr. W. D. Coleman, Augusta, Ga.
Dr. R. G. Curtin, Philadelphia.
Dr. Judson Daland, Philadelphia.
Dr. H. D. Didama, Syracuse.
Dr. Albert C. Getchell, Worcester, Mass.
Dr. James A. Hart, Colorado Springs.
Dr. Guy Hinsdale, Philadelphia.
Dr. A. Jacobi, New York.
Dr. F. S. Johnson, Chicago.
Dr. F. I. Knight, Boston.
Dr. R. P. Lincoln, New York.
Dr. J. H. Musser, Philadelphia.
Dr. E. O. Otis, Boston.
Dr. C. E. Quimby, New York.
Dr. Beverley Robinson, New York.
Dr. W. D. Robinson, Philadelphia.
Dr. J. E. Stubbert, Liberty, N. Y.
Dr. J. B. Walker, Philadelphia.
Dr. F. H. Williams, Boston.

In opening the meeting the President, Dr. Otis, said :

Gentlemen of the American Climatological Association : It is my very agreeable duty to welcome you to this, the fifteenth annual meeting of our Association. In my absence

from the country at the last meeting you conferred upon me this honorable office, and I take this, my first opportunity, to express to you my profound appreciation of your confidence, and to assure you of my most earnest desire to serve you with what ability I may possess. I can only ask your generous indulgence for whatever shortcomings may be manifest in the execution of my untried duties. Self-congratulation would ill become an association of the character and standing of ours, and yet it is a satisfaction, as well as an encouragement, to recognize the fact that our society has established itself upon the solid basis of a high order of scientific work. Its voice commands a respectful hearing, and with the profession at large its educative influence in the subjects to which it is devoted is not inconsiderable. To those gentlemen who, in its inception, devoted their energy and ability to its upbuilding, and whose professional rank assured its standing, we shall always owe a debt of gratitude. Some, alas, meet with us no more, but their memories will always be tenderly cherished by us. Their works do follow them, and their influence will be felt as long as the Association exists.

We meet in one of the beautiful spots of New England, suggestive in climate, grand in scenery. May we gather strength from the eternal hills about us, and inspiration from the pure air which their altitudes send down to us.

During the last year the Association has lost four valued members—Dr. Harrison Allen, of Philadelphia; Dr. W. D. Bratton, of Albuquerque, New Mexico; Dr. James Carey Thomas, of Baltimore, and Dr. William Pepper, of Philadelphia.

Dr. Allen's eminent and honored career as scholar, scientist, anatomist, and laryngologist is a matter of public record, but only those who enjoyed a personal acquaintance with him, as did many of the members of this Association, knew the charm of his gentle and gracious presence, and felt the power of his acute and versatile intellect.

Dr. Bratton was elected at our last meeting, and lost his life by an accident not long after, while serving in the yellow fever epidemic for which he had volunteered, having had large experience with this disease in the United States Marine Hospital Service. He illustrated that noble and unconscious heroism so often exhibited by members of our profession under conditions

of risk and danger. We are proud to have reckoned him among our number even for so short a time, and mourn his untimely death.

James Carey Thomas, of Baltimore, was in the sixty-fifth year of his age, and had been a member of this Society for ten years; physician, philanthropist, Christian, his life was devoted to the service of his fellow-men, and in it, as one always does, he found happiness and enthusiasm. Thus speak his own people in Baltimore of him: "One of the best and most public-spirited of her citizens, his life was largely spent in the promotion of the most beneficent, philanthropic, and educational work in our community and elsewhere. Of the Johns Hopkins University he was a trustee from its foundation, and chairman of the Executive Committee of the Board of Trustees for many years. He always took the deepest and most active interest in the work of the University. He took an ardent interest in the reform of municipal politics and government. He will long be remembered for his kindliness and sympathy in everyday life, and for his constant and conscientious service in many directions for the welfare and progress of the community. Eminent in his profession, a skilful practitioner, and a beloved physician, he was always an earnest advocate of the best education for both sexes and was a liberal contributor to many institutions having this end in view."

"All who came in contact with him soon recognized that he was in every way a good, a noble, and a manly man."

At the time of his death he was doing honorable service in the following ways: Trustee of the Johns Hopkins University; Member of the Medical Board of the Johns Hopkins Hospital; Trustee of the Haverford and Bryn Mawr Colleges; Vice-President of the Young Men's Christian Association of Baltimore, and formerly the President; President of the Thomas Wilson Fuel Saving Society; Trustee of the Thomas Wilson Sanitarium for Children; Vice-President of the Charity Organization Society; President of the Baltimore Manual Labor School; a Manager of the Society for the Suppression of Vice; Member of the Municipal Commission on Free Baths.

This Society, while mourning his loss, rejoices in the memory of such a life, and feels itself honored that he was for so long a time associated with it.

In the recent death of Dr. William Pepper—*vir illustrissimus*—this Society, as well as the whole medical profession of the country, has suffered an irreparable loss. As philanthropist, benefactor, educator, writer, and clinician of consummate skill, he was untiring in his service and devotion to mankind. To but few men is it permitted to leave such a stately monument of themselves as the enlarged and developed University of Pennsylvania. Unsparing of himself and his substance, he literally wore himself out in his service to others. Those of us who had the privilege of a personal acquaintance will recall the charm of his presence and his forgetfulness of self. Such a life lives on in the inspiration it brings to those who remain and as an incentive to lofty and unselfish aims.

Dr. Roland G. Curtin, of Philadelphia, was then called upon, and made the following communication:

HARRISON ALLEN, M.D.

Our President has assigned to me the sad duty of making a sketch of the valuable life of our late lamented member, Prof. Harrison Allen, who died at his home in Philadelphia on Sunday, November 14, 1897, of angina pectoris.

He graduated from the University of Pennsylvania in 1861, having for the subject of his thesis, "Entozoa Hominis."

In July of the same year he published a paper describing five African bats. In these two papers he foreshadowed an important part of his lifework.

A list of the valuable papers prepared and books written by him, and the positions that he successfully held, would take more space than is allotted to me. The mention of a few will be enough to impress you with the importance of his work as a citizen, a soldier, a surgeon, and a scientist.

He held five professorships in the University of Pennsylvania and one in the Philadelphia Dental College. He was President of the American Laryngological Society, the Association of American Anatomists, and the Anthropometric Society. He was also a member of many medical and scientific bodies at home and abroad. He had an international reputation as a scientist, especially in zoology and anthropology, and was highly esteemed as a surgical specialist. He was commissioned as an assistant surgeon in the United States Army in 1862, and served

in the Broad Street General Hospital in Philadelphia, then at Cliffburn General Hospital, Washington, D. C., and was afterward assigned to the field artillery of the Third Army Corps. Later, he was ordered successively to the Lincoln, Douglas and Carver Hospitals in Washington and the Seminary Hospital at Alexandria, Va. At the age of twenty-four years he was in responsible charge of the Mount Pleasant General Hospital in the city of Washington.

Prof. D. G. Brinton, M.D., said of Dr. Allen, in connection with his anthropological studies, that " everywhere his work was marked by a singular modesty of claim, by entire justice to the labor of others in the same field, by gentleness in criticising their results, by constant willingness to assist those who sought information, by an earnest desire to stimulate the love of knowledge for its own sake, and by unceasing efforts to present this knowledge in its broadest relation both to human welfare and abstract science."

Dr. Allen published about forty zoological papers, most of which related to the anatomy of man and the bats. In 1864 he published a quarto volume entitled, *A System of Human Anatomy.*

Dr. Allen was painstaking in his search after truth, and the results of his investigations were accepted as correct by the scientists, as they well knew that he first weighed carefully all his observations before placing them in the libraries of the scientific world.

In his religion he was also a " seeker after truth." Having been brought up a Hicksite Quaker, he, later in life, accepted the doctrines of Trinitarian Christianity, and, within a year before his death, was baptized according to the rules of the Protestant Episcopal Church.

His useful life is ended, his work is done. We miss his kind words and modest, quiet, Quaker-like demeanor. We lament his absence from our Association. Peace to his ashes.

Dr. John H. Musser, on being called upon by the President, made the following communication:

WILLIAM PEPPER, M.D.

The subject of this sketch was one of the founders of the American Climatological Association, and as President guided

its deliberations at the meeting held in Philadelphia in 1886. At this meeting the official and formal address delivered by him had for its title "Phthisis in Pennsylvania." The members may recall the comprehensive study of the subject presented by the rare and excellent model he laid down for future workers in similar fields. It is not to be forgotten that the detail work and enormous labor required, as well as suggestions in its conception, were due to our present efficient Secretary. As was customary with the late Dr. Pepper, he was always willing to give credit to those who were associated with him in his work, and in this instance acknowledged his indebtedness to our Secretary by coupling his name with that of his own when the article was published. Our Ex-President, a foremost founder whose loss we deplore, was for a long time interested in climatology. He had prepared, as long as twenty years ago, most comprehensive plans for a work in this department of medical science. He had arranged to have data collected from each county and every State which would throw light upon the climate of its region, including a study of the atmosphere, the soil, the vegetation, the animal life, and all other physical matters relating to climate. Another of our co-workers was associated with him in this work, and I believe Dr. Daland has published the results of many of their conjoint investigations. On scientific lines—which we climatologists appreciate—the late Dr. Pepper also engaged in an exhaustive study of the mineral springs of America. In addition, other contributions to our Society's transactions were made by him, and his voice was often familiar in its deliberations.

The work which appeals to us as menbers of this Society was a very small portion of the labor which our fellow-member carried on in strictly professional lines, and when both are added together the sum represents but a fraction of the labors of his busy and useful life.

Receiving the degree of doctor of medicine in 1864 he at once became resident physician to the Pennsylvania Hospital. In this capacity he published a paper conjointly with Dr. Meigs on the subject of "Pigment Formation and Deposition in Malaria," at that day an advanced contribution in pathology. He at once became interested in the study of pathology, and the first excellent descriptive catalogue of the rich museum of the

Pennsylvania Hospital is testimony of the enthusiasm of the worker. His studies in this line and his energy and zeal attracted to him the late distinguished Dr. J. Forsyth Meigs, then Physician to the Pennsylvania Hospital and the leading practitioner in medicine in Philadelphia. He associated with himself the subject of this sketch in the preparation of a new edition of his work on *Diseases of Children*, and from this time until the death of Dr. Meigs the combined production of the authors was the leading work on this subject.

One of the early students in pathology of his alma mater, naturally he should have been selected to deliver the first lectures on "Morbid Anatomy" in the University of Pennsylvania, which for two years he conducted with rare ability. During this time he took active interest in the Philadelphia Pathological Society. He was a frequent contributor to its proceedings, a member of its most active committees, and for three years (1873–1876) was its energetic President. He never lost interest in pathology, as his varied contributions on this subject show, while the power and clearness of his later lectures, both clinical and didactic, were enhanced by the wealth of his pathological knowledge.

It is interesting to note in passing the number of clinical and practical workers in medicine who, in their earlier days, were zealous students in pathology. In the city of his birth alone we can point to the elder Gross as the foremost pathologist of his time, and it is now a mooted question whether his reputation will not be greater for the contributions he made to pathology than for those he made to surgery. Likewise we have Da Costa, in truth the first organizer of the Pathological Society, and one of its most active workers, later our brilliant clinician.

I have said Dr. Pepper's interest in pathology continued to the last. So clearly did he appreciate the relations of pathology to clinical medicine that in the last year of his life he founded and endowed the William Pepper Clinical Laboratory for the purpose of studying the pathological problems in clinical medicine.

In 1866 the late Dr. Pepper was elected physician to the Philadelphia Hospital, and at once threw himself with his accustomed ardor into clinical studies. His practical mind delighted in practical studies. Pathology lost the student that

clinical medicine gained. Epidemics of typhus fever and of relapsing fever attracted him into exhaustive studies. The prosecution of his studies in typhus fever was so closely conducted as to permit him to be infected by the disease. Both studies enabled him to make valuable contributions to the literature of these infections, embodied in his papers in the *System of Medicine* and in his work on the *Practice of Medicine*.

At this time two friends, whose brief career was an earnest of what would have been possible had life been spared them, were associated with him—the one, Dr. John S. Parry, well known for his clinical papers on "Rhachitis," on "Extra-uterine Pregnancy," and on "Relapsing Fever," died of tuberculosis; the other, Dr. Edward S. Rhodes, died of organic heart disease. Always delicate, his strength did not allow full play of his talents. The dainty and delicate biographical sketch of him is one of the best pieces of work Dr. Pepper ever did. Dr. Pepper's life at that time was influenced by the gentleness, kindness, and courteousness of his brother, Dr. George Pepper, whose untimely death robbed Philadelphia medicine of what bade fair to be a shining light. Every one acquainted with Dr. Pepper knows with what loving tenderness he frequently referred to his brother's character and talents.

In 1870 Dr. Pepper was made Lecturer in Clinical Medicine and in 1874 Professor of that branch in his alma mater. From this time forward he threw his whole energies into clinical medicine, and, up to the time he was elected Provost of the University of Pennsylvania, pursued his studies with energy and ability. Frequent contributions in the form of lectures and monographs appeared, notably his paper on the "Catarrhs," on "Diseases of the Right Iliac Region," on "Pernicious Anæmia," and on "Leucocythæmia." His lecture-room was crowded, and there was always a waiting list for his private course in physical diagnosis. His medical labors did not culminate with his election to the provostship, although they took on a different aspect coincident with his labors as organizer of medical thought and medical effort. Thus, in 1884, appeared the classic treatise, *A System of Medicine* which he edited; and in 1890 he gathered around him a number of associates who contributed to his last systematic work, *The Practice of Medicine*. In the mean time many able papers were published by him in conjunction with

Hare, Packard and Griffith, and later more extensively with Stengel.

In 1870 events of great significance aroused in the late Dr. Pepper traits dormant because of the lack of opportunity to display them. The removal of the University to West Philadelphia and the recognition by Agnew, Pepper, Wood, Norris, and Tyson of the necessity for a hospital in the normal plant of a medical school called for new work. As chairman of the Building Committee, by his personality, his tact, and his force, he managed legislative bodies, laid the wealthy under tribute, and organized the alumni to potent work. In 1876 he was Medical Director of the Centennial Exposition, for the management of which he received a knighthood from the King of Sweden. The cause of medical education found in him a tireless champion, and addresses, pamphlets, and organizations followed on until he saw the passing of the old. Other demands upon him show the receptivity of his mind, his broad culture, and abundant resources. Then followed his election to the provostship, and from this time on medicine lost a devotee whose purpose singly had been devoted to this cause. Science, education, his alma mater, the State of his birth gained a champion whose ardor and energy never paled until the hour of his death. His friends truthfully claimed for him a place among the first teachers and clinicians of his day, a position which he reluctantly relinquished. Henceforth the multiplicity of his labor appalls. We have referred to the medical labors; others not relevant to this organization need not detain us, save that mere mention indicates the genius of the man.

He reorganized entirely the University of Pennsylvania and established five new and most successful departments. He threw his whole soul into the University Extension movement, was the first president of the local, and later of the national, society. He assisted in the organization and was the first President of the American Archæological and Palæontological Societies and the Philobiblon Club. He was President of the Museums of Science and Art of the University and of the Commercial Museums of Philadelphia. He organized and was President of the Free Library of Philadelphia, an organization which places in circulation more books than any similar library in the country. Lately he had been Vice-President and leading spirit of the

American Philosophical Society, and was an enthusiastic patron of the Oriental Society. He assisted in the organization of the Congress of Physicians and Surgeons and was chairman of the first Business Committee; he was also one of the founders of the Association of American Physicians, and later President of that distinguished body. He was the founder of the Pan-American Medical Congress and its first President.

The late Dr. Pepper was born August 13, 1843. He was the son of Dr. William Pepper, former Professor of Medicine in the University of Pennsylvania. He died July 18, 1898, of angina pectoris. A widow and three sons survive. In him both tact and talent were well combined, and to both were added great industry and energy and a personality of extreme force and attractiveness.

The opening address was then made by the President, Dr. E. O. Otis, of Boston.

Subject: Auenbrugger and Laennec, the Discoverers of Auscultation and Percussion.

The following papers were then read:

"Common Errors of General Practitioners in Dealing with Cases of Pulmonary Tuberculosis," by Dr. F. I. Knight, of Boston.

Suggestions: "The Result of Recent Experience with Phthisical Patients," by Dr. Vincent Y. Bowditch, of Boston.

These papers were discussed jointly by the following members: Dr. Didama, Dr. Walker, Dr. Curtin, Dr. Musser, Dr. Hart, Dr. Quimby, Dr. Coleman, and Dr. Beverley Robinson. Dr. Knight closed the discussion.

At the business meeting following the morning session on the first day the President appointed the Committee on Nominations: Drs. Knight, Curtin, Hart, Coleman, and Walker. The President also appointed the following committee to audit the account of the Treasurer: Dr. G. R. Butler and Dr. W. D. Robinson. The session was then adjourned.

In the afternoon at two o'clock the members of the Association and the ladies accompanying them, through the courtesy of Dr. C. F. McGahan, enjoyed a drive to Franconia and the Profile. Luncheon was served, and a vote of thanks was tendered to Dr. McGahan for this very enjoyable feature of the

meeting. A telegram was ordered to be sent by the Secretary in appreciation of this attention.

After returning to Maplewood the Association was convened at 8.30 P.M. A paper entitled "Notes on the Position of the Lower Border of the Heart and its Topographical Relations," was read by Dr. Glentworth R. Butler, of Brooklyn, and discussed. The next paper was entitled "A Case of Dissecting Aneurism of the Thoracic Aorta Rupturing into the Pericardial Sac and Causing Immediate Death," by Dr. Judson Daland, of Philadelphia. After discussion the meeting adjourned.

September 1st. The Association was called to order by the President at 9.30 A.M. At the morning and afternoon sessions the remaining papers on the programme were read and discussed. (See Table of Contents, page v.)

Business Meeting.

The Secretary and Treasurer reported that all bills have been paid to date and that there is at present in the treasury $170.41. The chief items of expense were for Volume XIII. of Transactions, which cost $403.27, and the assessment made on account of the expenses of the Fourth Congress of American Physicians and Surgeons, amounting to $105. This Association pays next to the largest assessment for the Congress, and will probably head the list for the Fifth Congress. We are required to elect a delegate and alternate this year to represent us on the Executive Committee of the next Congress in Washington, to be held in 1900.

The changes in our membership have been as follows: By death during the past year, four, viz.: Dr. Harrison Allen, Dr. W. D. Bratton, Dr. J. Carey Thomas, and Dr. William Pepper, President of the Association in 1886. By resignation, Dr. G. M. Garland and Dr. S. B. Ward. This leaves a present active membership of 115 members. By a resolution introduced at the last annual meeting we are permitted at the present meeting to alter our Constitution so as to create a grade of corresponding members, and it is believed that by having such representatives in various quarters of the globe our influence may be extended and our active membership indirectly benefited. The names of seven men of eminence are proposed as corresponding

members. Fifteen names are presented, having been properly indorsed, for active membership.

The last volume of the TRANSACTIONS (No. XIII.) has been distributed to the members and to about seventy libraries, journals, and individuals in this country and abroad. In distributing copies to foreign lands we have had the free services of the International Bureau of Exchanges connected with the Smithsonian Institution at Washington, to which we make acknowledgment.

Volume I. is out of print and cannot be had.

The Secretary has received over three hundred letters and documents relating to the business of the Association during the past year, all of which have been answered when necessary, and properly filed.

Meetings of the Council have been held twice during the past year in Philadelphia in order to arrange the details of the meeting in Maplewood and for such other business as would naturally come before it.

Dr. Jacobi inquired as to the article in the Constitution relating to absentees. Section 4 of Article III. was then read by the Secretary.

Dr. R. G. Curtin moved, in accordance with the recommendation of the Council at the meeting in Washington, 1897, that the Constitution be changed, so that Article III., Section 1, shall read, "This Association shall consist of *Active*, *Corresponding*, and *Honorary Members;* the latter shall not exceed ten."

Article III., Section 3, "The power of nominating Honorary and Corresponding Members shall be vested in the Council." Seconded by Dr. J. B. Walker; carried.

Dr. A. Jacobi offered the following amendment to the first clause of Section 2, Article III. of the Constitution: Names of candidates for active membership *whose applications have been* indorsed by two active members shall be sent to the Secretary at least thirty days before the annual meeting.

In accordance with the Constitution the amendment lies over until the next annual meeting.

The following propositions for membership, properly indorsed, and recommended by the Council, were individually balloted for and were elected:

For Active Membership:

Dr. Howard S. Anders, of Philadelphia.
Dr. Edward L. Baldwin, of Saranac Lake.
Dr. S. Westray Battle, of Asheville.
Dr. D. R. Brower, of Chicago.
Dr. L. D. Bulkley, of New York.
Dr. W. E. Casselberry, of Chicago.
Dr. Walter F. Chappell, of New York.
Dr. R. A. Cleemann, of Philadelphia.
Dr. E. C. Dudley, of Chicago.
Dr. Albert C. Getchell, of Worcester, Mass.
Dr. Samuel K. Merrick, of Baltimore.
Dr. J. E. Stubbert, of Liberty, N. Y.
Dr. James Tyson, Philadelphia.
Dr. Herbert B. Whitney, of Denver.
Dr. Harold Williams, of Boston.
Dr. F. H. Williams, of Boston.

For Corresponding Membership:

Dr. G. G. Eyre, of Claremont, Cape Town.
Dr. Samuel Gache, of Buenos Ayres.
Dr. Eduardo Liceaga, of Mexico.
Dr. Domingo Orvananos, of Mexico.
Dr. Carl Ruedi, of Arosa, Switzerland.
Dr. Septimus Sunderland, of London.
Dr. Clement L. Wragge, of Brisbane, Australia.

The Auditing Committee then reported that they had examined the Treasurer's account, and found the same to be correct, and that there are $170.41 in the treasury.

The Committee on Nominations reported the following recommendation:

For President, Dr. Beverley Robinson, of New York.

For Vice-Presidents, Dr. James A. Hart, of Colorado Springs, and Dr. Richard C. Newton, of Montclair, N. J.

For Secretary and Treasurer, Dr. Guy Hinsdale, of Philadelphia.

For Member of the Council, Dr. E. O. Otis, of Boston.

For Representative to the Executive Committee of the Fifth Congress of American Physicians and Surgeons, Dr. F. I.

Knight, of Boston; alternate, Dr. R. G. Curtin, of Philadelphia.

The foregoing were then duly elected.

The Council reported that after considering various places for the meeting of 1899 they recommended that the session be held in New York City in the month of May, unless it should be ascertained that a majority of the members desiring to be present should prefer another date. The recommendation of the Council was adopted by the Association.

A vote of thanks was ordered by the Association to be given to Messrs. Ainslie and Webster, the proprietors of the Maplewood Hotel, for their courtesies to the Association. A vote of thanks was extended to the President, Dr. E. O. Otis, and to the Secretary, Dr. G. Hinsdale, for their services in planning and carrying out the arrangements for the meeting, which was thoroughly enjoyed by all who took part. The annual meeting then adjourned.

On the following day, September 2d, a party of twenty-two made the ascent of Mount Washington, elevation 6293 feet, dined at the Summit and, in disbanding, closed a memorable meeting of the Association.

GUY HINSDALE,
Secretary.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

Article I.—Name.

This Society shall be known as the American Climatological Association.

Article II.—Object.

The object of this Association shall be the study of *Climatology and Hydrology and of Diseases of the Respiratory and Circulatory Organs.*

Article III.—Membership.

Section 1.—This Association shall consist of *active, corresponding,* and *honorary* members, the latter not to exceed ten.

Sec. 2.—Names of candidates for active membership, indorsed by *two* (2) active members, shall be sent to the Secretary at least thirty (30) days before the annual meeting. On approval of the Council, the applicant shall be balloted for at the annual meeting. Three (3) black balls shall be sufficient to reject a candidate. The Council shall have power to nominate active members.

Sec. 3.—The power of nominating honorary and corresponding members shall be vested in the Council. The election shall be conducted in the same manner as that for active members. Honorary members shall enjoy all the privileges of active members, but shall not be allowed to hold any office or cast any vote.

Sec. 4.—Any member of the Association absent from the meetings, in person or by contributed paper, for three (3) con-

secutive years, without sufficient cause, may be dropped from the list of members by vote of the Council.

Article IV.—Officers.

Section 1.—The officers of this Association shall consist of a *President*, two *Vice-Presidents*, a *Secretary and Treasurer*, who, with five other members, shall constitute the *Council* of the Association.

Sec. 2.—Nominations. The officers, including the Council, shall be nominated by a committee of five (5) members, which committee shall be nominated by the President at the first session of each annual meeting, and shall report at the business meeting.

Sec. 3.—Elections. The election of officers shall take place at the business meeting. A majority of votes cast shall constitute an election.

Sec. 4.—The President, Vice-Presidents, Secretary and Treasurer shall enter upon their duties at the close of the annual meeting at which they are elected, and shall hold office until the close of the next annual meeting, or until their successors are elected.

Sec. 5.—Members of the Council, other than the President, Vice-Presidents, Secretary and Treasurer, shall hold office for five (5) years.

Sec. 6.—Vacancies. Any vacancy occurring among the officers of the Association during the year may be filled by the Council.

Article V.—Duties of Officers.

President and Vice-Presidents.

The President and Vice-Presidents shall discharge the duties usually devolving upon such officers. The President shall be *ex-officio* Chairman of the Council.

Secretary and Treasurer.

As Secretary, he shall attend and keep a record of all the meetings of the Association and of the Council, of which latter.

he shall be *ex-officio* Clerk. At each annual meeting he shall announce the names of all who have ceased to be members since the last report. He shall superintend the publication of the TRANSACTIONS, under the direction of the Council. He shall notify candidates of their election to membership. He shall send a preliminary notification of the annual meeting two (2) months previous thereto, and the programme for the annual meeting at least two (2) weeks previous to its assembly, to all the members of the Association. He shall also send notification of the meetings of the Council to the members thereof. At each annual meeting of the Association he shall read the minutes of the previous meeting and of all the meetings of the Council that have been held during the current year.

As Treasurer, he shall receive all moneys due, and pay all debts therewith. He shall render an account thereof at the annual meeting, at which time an auditing committee shall be appointed to report.

ARTICLE VI.—COUNCIL.

The Council shall meet as often as the interests of the Association may require.

Four (4) members shall constitute a quorum.

It shall have the management of the affairs of the Association, subject to the action of the Association at its annual meetings.

It shall consider the claims of candidates recommended to it for admission to membership.

It shall not have the power to make the Association liable for any debts exceeding in total one hundred dollars ($100), in the course of any one year, unless specially authorized by a vote of the Association.

It shall have the entire control of the publications of the Association, with the power to reject such papers or discussions as it may deem best.

It shall have power to nominate active members at the annual meeting.

The Council shall have power to invite any gentleman, not a member, to read a paper at the annual meeting, on any subject within the scope of the objects of this Association.

The Council shall determine questions by vote, or—if demanded—by ballot, the President having a casting vote.

The Council shall constitute a Board of Trial for all offences against the Constitution and By-Laws, or for unbecoming conduct, and shall have the sole power of moving the expulsion of any member.

The President, or any two members, may call a meeting, notice of which shall be transmitted to every member two (2) weeks previous to the meeting.

Article VII.—Papers.

Section 1.—The titles of all papers to be read at any annual meeting shall be forwarded to the Secretary not later than one (1) month before the first day of the meeting, in order to appear on the printed programme.

Sec. 2.—No paper shall be read before the Association which has already been printed or been read before another body.

Article VIII.—Quorum.

A quorum for business purposes shall be ten (10) members.

Article IX.—Amendments.

This Constitution may be amended by a four-fifths ($\frac{4}{5}$) vote of all the members present at an annual meeting, provided that notice of the proposed amendment has been printed in the notification of the meeting at which the vote is to be taken.

BY-LAWS.

1. Meetings of the Association shall be held annually.
2. The time and place of the meetings shall be determined by the Council.
3. The dues of active members shall consist of an annual assessment not to exceed five ($5) dollars. Members in arrears shall not be entitled to vote. Those in arrears for two (2) years

may be dropped from membership by recommendation of the Council.

4. Order of business meeting.

First day:

Calling the roll of members.

Minutes of previous meeting.

Treasurer's report.

Appointment of auditing committee.

Appointment of nominating committee.

Report of Council on recommendations for membership.

Second day—Morning session:

Report of nominating committee.

Election of officers.

Election of members.

Report of the committee on health resorts.

Miscellaneous business.

Adjournment of business meeting.

Any of these By-Laws may be amended, repealed, or suspended by a two-thirds vote of the members present at any meeting.

PRESIDENT'S ADDRESS.

AUENBRUGGER AND LAENNEC, THE DISCOVERERS OF PERCUSSION AND AUSCULTATION.

By EDWARD O. OTIS, M.D.,
BOSTON.

It is quite improbable, I think, that we should be here to-day, or, indeed, have an existence as a society largely devoted to the consideration of diseases of the chest, were it not for the methods of thoracic examination which Auenbrugger and Laennec have given us in their discoveries of percussion and auscultation. Without these two precious methods of investigation we could scarcely have arrived at any degree of precision or certainty in thoracic pathology, and might have been not unlike the old physicians and surgeons who would "swear," as Morgagni says, that there was fluid in the chest when in reality there was not a "single drachm," or perform paracentesis of the thorax upon a duke for an empyema which did not exist.[1]

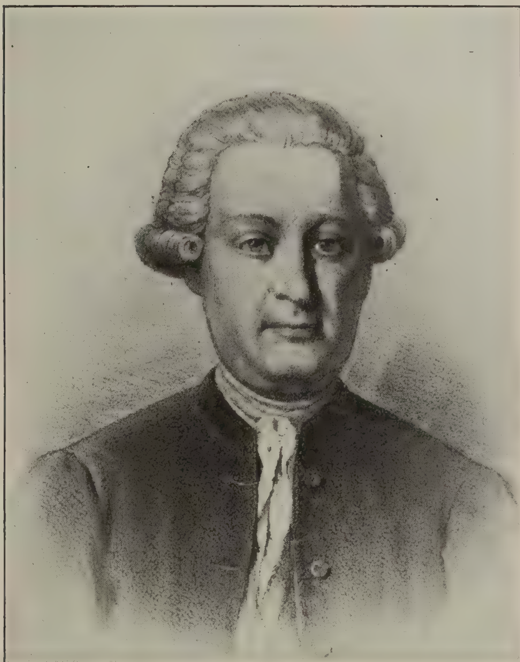
It has seemed to me, then, eminently fitting that this Society should honor the memory of these illustrious men, by reviewing their lives and work, and be not unmindful of the debt of gratitude we owe them for their inestimable contributions to the science of our art and to humanity. In entering into their labors as we percuss the chest and apply the stethoscope, which reveals so exactly to the trained ear the condition within, let us not forget the years of patient toil and investigation of Auen-

[1] Oliver Wendell Holmes. Dissertation on Direct Exploration in Medical Practice, Boylston Prize Essay, 1839.

brugger and Laennec, which, with native genius, resulted in their immortal discoveries.

Leopold Auenbrugger, whose *Inventum Novum* was given to the world in 1761, was born in the historic town of Grätz, Austria, in 1722. His father, Sebastian Auenbrugger, was a well-to-do freeman of blameless character, and both he and his wife, Maria Theresia, were well known for their kind-hearted and charitable dispositions, the kind of ancestry that has so often produced illustrious descendants. Leopold, their son, was brought up in a good, plain fashion, with pious and Christian instruction, and studied literature and philosophy at the university then existing at Grätz. Undoubtedly his parents discovered more than ordinary ability in him and determined to give him "privileges." What influence, if any, directed his attention to medicine we do not know; not unlikely he was "born to it," as we say, as some people seem to be destined almost from birth to certain careers, they develop a taste for them so early. At all events he devoted himself to its study with extraordinary application and untiring industry, and completed his studies at the University of Vienna under van Swieten, graduating with great distinction.

He settled in Vienna, and after some years of private practice he was appointed, at the age of twenty-nine, in 1751, physician to the Spanish Military Hospital, which was the best and largest at that day in Vienna. This position he held for seventeen years, until 1768, when, a change taking place in the hospital, he retired to private practice, devoting himself untiringly to the study and practice of his profession. He manifested the same kind-hearted and charitable disposition characteristic of his father. To the poor he gave his valuable services freely, and with the same care and attention as to those who paid him well; particularly was this the case toward those from his own province. His benevolence and kindness extended to all about him: to his family, his servants, his poor patients, and every one who came in contact with him. Charity, the leading trait in his character, was a virtue with him. He took poor students, clothed and fed them until they could finish



LEOPOLD AUENBRUGGER.

their studies; and many physicians and surgeons were indebted to him for their start in life. What a beautiful picture this of the unselfish, humanity-loving physician, often enough repeated, be it said, to the honor of our profession, in this and all ages.

Possessed of an excellent constitution and enjoying good health, he continued untiring and indefatigable in his professional duties, even to his latest days, full of goodness and philanthropy, as his great-grandson says. In chest diseases he was considered most skilful. His door-bell led to his sitting-room, and his little hand-lantern was always in readiness, by the light of which he not infrequently went alone to visit his patients, even to the remotest suburbs. One can see, in imagination, the kindly old physician trudging through the empty streets of the city at night, guided by the feeble flicker of his lantern, bound on his errand of mercy; to detect, perchance, some thoracic disease by the use of his own discovery; eager to the last to prove again and again the value of percussion. He was always a student and investigator, and was accustomed to make voluminous notes and histories of his important cases. He possessed a large library—rather unusual in those days, I fancy—and was a friend of the philosopher Werner. He was also fond of music, and for a great many years he used to frequent a certain baron's house every Sunday in the winter season to attend a musical matinée. He wrote a comic opera, entitled the "Rauchfangkehrer" (chimney-sweeper), which attracted the attention of the Empress Maria Theresa, who asked him to write another; but he replied that he had something better to do than to write comedies.

His home life was a happy one, having been married at a comparatively early age (thirty-two) to Mariana von Priestersberg, with whom he had fallen in love when a student. They celebrated their golden wedding in 1804, a few years before his death. He had two children (daughters), one of whom spoke and wrote both Latin and Greek, and was a remarkable pianist; the other was noted for her beauty and wit. In the latter part of his life he lost the sight of one eye, but the other

was so sharp that he could use it in reading and writing, and from his house could tell the time upon the tower of a neighboring cathedral. His mode of life was very simple; and in his latter years he rarely touched meat, but subsisted upon soup, vegetables, and light farinaceous food. Two years before his own death his beloved wife, Mariana, died, and from that time he took little interest in life, remained most of the time in his study, and saw with pleasure only his granddaughters. His death was from the result of a cold, probably the pneumonia of old age. He retained his senses to the last, and predicted the day and hour of his demise. Looking up to the clock upon the wall in his room, he said, "When two strikes the end will come." And it so happened, in 1809, in the eighty-seventh year of his age.

Auenbrugger was ennobled by Kaiser Josef in 1784, and given the title of Elder von Auenbrug, "in consideration," as it states, "of his useful services rendered to the public through his ability and excellent skill in medicine." "His life," says Dr. Clar, who collected the fragmentary sketches of his career, "was a model of modesty, philanthropy, genuine devotion to the science and art of medicine, and of kindly regard toward the poor as well as the rich." In him was exemplified the highest type of the physician in private practice, uniting an extraordinary talent for investigation, intense devotion to his patients, and—an indispensable attribute for a practical physician—a sympathetic disposition. And, after all, is not the varied experience in the school of private practice the finest kind of training to make a well-rounded physician and man? keeping his medical sense keen and alert, his sympathy acute, his intellect active, his charity and compassion great, and his manners gentle, refined, and gracious. Each patient is a clinic, and often a liberal education to him. It has sometimes seemed to me that excessive hospital practice has proved rather an injury to some physicians, at least to their manners, if not to a thorough and careful analysis of their cases; perhaps, however, it is in the man rather than in the circumstances of his environment.

Although we possess but these meagre and fragmentary records of Auenbrugger's life, yet it is enough to enable us to fill in the lines and gain a pretty distinct idea of his personality and character. With some persons one does not need to be acquainted with much of the detail of their lives in order to know what manner of men they are; a few characteristic illustrations here and there in their career reveal the spirit and motive in life, and show the kind of men they are, quite as well and clearly as an extended and continuous biographical narrative. Always enthusiastically devoted to the study of disease, Auenbrugger escaped the not infrequent misfortune of the student—a loss of sympathy with one's kind. His love for his fellow men, for suffering humanity, for struggling students in his own profession, kept pace with his love for medical study. He never sacrificed the *man* for the scientist; nor did he lose his interest for other things in life, as happens sometimes with men intensely devoted to one pursuit. "A man of original powers," as some one has truly remarked, "can never be confined within the limits of a single field of activity."

He was interested in music, philosophy, and the drama, and well illustrates what Dr. Da Costa has so happily styled "the scholar in medicine." With dignity, sympathy, enthusiasm in his profession even to the last; ever seeking to improve and add to his art; modest, like most great men; never refusing to give of his best to suffering humanity, he richly lived out his long life. As we teach our students percussion, as a matter of just recognition and due honor, let us tell them something of the life of its discoverer, at least his name, which I fear but few who avail themselves of the result of his long and arduous labors know.

Besides the *Inventum Novum,* Auenbrugger published several papers, but his reputation rests, of course, upon the first. He was thirty-nine years of age when it appeared, and had then had a hospital service of ten years. For seven years, as he says in his preface, he had been observing and reflecting upon it. "Scripsi illa, quæ sensum testimonio inter labores et tedia iterum iterumque expertus sum." "I have written that

which I have proved again and again by the testimony of my own senses, and with laborious and tedious exertions." It is written in Latin, as most scientific works were in those days. He has not been ambitious of ornament, he says, in his mode or style of writing, being content if he should be understood. He begins his preface with the fact of his discovery. "Sisto tibi benevole lector, signum novum in detegendis morbis pectoris a me inventum." "I present to you, charitable reader, a new sign which I have discovered for detecting diseases of the chest. This consists in the percussion of the human thorax, from the varying resonance of the sounds of which an opinion can be formed of the internal condition of this cavity. In making public my discoveries respecting this matter I have been actuated neither by an itch for writing nor a fondness for speculation, but by the desire of submitting to my brethren the fruits of seven years' observations and reflection. In doing so I have not been unconscious of the dangers I must encounter; since it has always been the fate of those who have illustrated or improved the arts and sciences by their discoveries to be beset by envy, malice, hatred, detraction, and calumny." Alas! he had to endure what was perhaps harder to bear than any of these evils—neglect. "For many years after the discovery Stoll alone acknowledged its value,"[1] having both used and taught it during the years from 1776 to 1784, and refers to it in his writings.

It was not, however, until forty seven years later, in 1808, a year before Auenbrugger's death, that Corvisart, the first Napoleon's physician, and teacher of Laennec, revived the discovery by translating the *Inventum Novum* into French with copious commentaries; thus, in truth, making almost as great a discovery himself by discovering the original discovery. Corvisart,[2] when he commenced his studies, had never heard of the name of Auenbrugger, and was completely ignorant of his discovery, until, in reading the works of Stoll, he became aware of it. From that time he practised percussion with persever-

[1] Gee. Auscultation and Percussion. London, 1893.
[2] Mailliot. Traité Pratique de Percussion. Paris, 1843.

J. N. CORVISART.

ance upon the living as well as upon the cadaver, and after twenty years of observation and experience he translated Auenbrugger's work with his own voluminous commentaries. He demonstrated daily in his clinic the immense advantages of percussion, and popularized it among his pupils, who soon extended the knowledge of it throughout France and in all Europe. "The complete ignorance," says Mailliot, "of Auenbrugger's work in France; the works, great reputation, and high position of Corvisart would have made it very easy for him to have appropriated Auenbrugger's work;" a lesser man might have yielded to the temptation, but not the noble-minded Corvisart. "I know very well," he says in his introduction, "how little honor there is in a translation with commentaries, and I might have elaborated anew Auenbrugger's discovery and made an independent work upon percussion, and so attained the rank of an author, and in this way sacrificed Auenbrugger's name to my own vanity. This I did not want to do; 'C'est lui, c'est sa belle et legitime découverte (inventum novum, comme il le dit justement) que j'ai voulu faire revivre." Corvisart was a great physician, but this fine act shows him to have been a great man as well.

At the conclusion of his preface Auenbrugger adds a sort of note, or, as he calls it, "Monitorium ad omnes medicos," in which he says: "I declare from experience, that this sign of which I treat is one of the greatest importance not only in detecting disease but also in curing it, and therefore merits the first place after exploration of the pulse and respiration. For, indeed, in whatever disease an unnatural sound of the thorax shall be observed, it will always indicate a grave danger." He closes his treatise with these memorable words: "Cedant hæc miseris in solatium, veris autem medicinæ cultoribus in incrementum artis; quod opto"—"May this work yield solace to the wretched, but to the genuine students of medicine an addition to their knowledge of the art; this I hope for." And Corvisart adds: "The concluding wish and prayer of the author have not been made in vain. This little treatise, as every candid practitioner may readily convince himself, contains most luminous

precepts respecting the practice of percussion, and most exact and faithful observations on several diseases which were previously either misunderstood, singularly neglected, or respecting which very erroneous notions were for the most part entertained." And Skoda remarks: "Auenbrugger, with the fullest right, deserves the honor of being considered the founder of the new method of diagnosis."

Why a discovery of such evident and inestimable value and of such practical and simple application should have remained so long unappreciated and neglected, it is difficult to say. One reason readily occurs to us: Auenbrugger was never a teacher, and, unlike Laennec, he had no pupils to learn and extend his discovery. "It is possible," says Hudson,[1] "that had not Laennec survived his discovery for some years and continued to demonstrate its employment and results to the younger generation, it might have left as slight an impression on the minds of the profession as had the treatise on percussion by Auenbrugger, which preceded it." Another reason may have been a tendency in the profession of that age to devote itself inordinately to the study of the Hippocratic doctrines and their elaboration, rather than a desire to enlarge the boundaries of medical science by experiment and investigation.

To rest content with present achievement is always fatal to future progress, and is likely to produce an unfavorable mental attitude toward any new discovery. How Auenbrugger felt about it himself we can only conjecture. That he was convinced that it was a substantial and important contribution to the science of medical diagnosis we can feel assured from the fact that he was content to leave it to time to establish, for he never wrote regarding it again. He would not have been human, however, if he had not experienced a bitter disappointment, as the years rolled by, in observing how little recognition it obtained, and how little it was used, but his philosophy and experience doubtless taught him that this had been, and would be, the fate of many another discoverer. Nevertheless, he

[1] British Medical Journal, vol. ix., 1879.

had the satisfaction of using it himself during his long years of practice, and while the rest of the medical world were groping in darkness over the diseases of the chest, he was enabled to illumine them by the light of his matchless discovery.

The treatise is written in Latin, as I have said, in the curious form of observation, axiom, and scholium. Dr. Forbes, who translated it into English in 1824, says: "It is certainly written in no very classical style of Latinity." It is, however, for the most part clear and simple. The principles are two, as Gee[1] says: "first, that the sounds produced by percussion must be regarded simply as acoustic phenomena, and named accordingly; secondly, that the sounds are to be explained by reference to corresponding physical states—that is to say, to the presence or absence of air in the parts percussed." Upon these principles, as we know, percussion stands firmly established to-day.

Auenbrugger begins by describing the natural sounds of the chest, the method of percussion, and then the unnatural or morbid sounds. He next proceeds to describe the acute and chronic diseases in which these morbid sounds are observed. An observation or chapter is devoted to fluids in the chest; another to affections of the chest not indicated by percussion. One treats of the appearance of the organs on dissection in cases where the preternatural sounds of the chest had been observed. The tenth observation treats of scirrhus of the lungs and its symptoms. The eleventh, of vomicæ in general. The twelfth, of dropsy in the chest; hydrothorax, pleurisy, and dropsy of the pericardium. The thirteenth, of copious extravasation of blood; and the fourteenth and last, of aneurism of the heart. In his first observation he strikes the keynote of his subject, when he begins: "Thorax sani hominis sonat, si percutitur." "The thorax of a healthy person sounds when struck." The sound thus elicited from a healthy chest resembles the stifled sound of a drum covered with a thick woollen cloth or other envelope. The most sonorous region is

[1] Gee. Auscultation and Percussion, 1893.

from the clavicle to the fourth rib anteriorly. While undergoing percussion on the foreparts of the chest, the patient is to hold his head erect, and the shoulders are to be thrown back, in order that the chest may protrude, and the skin and muscles drawn tight over it; a clear sound is thus obtained.

One should percuss many well persons in order to obtain an idea of the variation of the percussion noted in individuals of different form and condition. Percussion should also be practised in natural respiration and upon full inspiration. What better directions for learning good percussion does any modern manual upon the subject give? Regarding sound and tone, "Auenbrugger," says Gee, "in a sentence of fourteen words had summed up the acoustic phenomena of percussion: 'Sonitus vel altior, vel profundior, vel clarior, vel obscurior, vel quandoque probe suffocatus deprehenditur.' The sound is a tone, clear or muffled, even to complete privation; the tone is of a pitch higher or lower." In treating of percussion of the chest in disease, he says: "If over the foredescribed pulmonary region, we perceive not the foredescribed pulmonary sound, equal on both sides, the force of percussion being equal, we may predicate the existence of disease where the sound is unnatural." "This," as Gee says, "comprises the whole theory of percussion."

"If a sonorous part of the chest," he continues, "struck with the same intensity, yields a sound duller than natural, disease exists in that part. If a sonorous region of the chest appears on percussion entirely destitute of the natural sound, that is, if it yields only a sound like that of a fleshy limb when struck, disease exists in that region. The duller the sound, and the more nearly approaching that of a fleshy limb stricken, the more severe the disease. The want of the natural sound behind indicates more danger than it does on the anterior and superior part of the chest." In speaking of mental affections as causes of pectoral disease, he says: "I have observed none more powerful in rendering obscure the natural resonance of the chest than the destruction of cherished hopes." This reminds one of Shakespeare's well-known lines:

"She never told her love,
But let concealment, like a worm i' the bud,
Feed on her damask cheek; she pined in thought."

Dr. Clar thinks he came perilously near the discovery of auscultation when, in treating of vomicæ, he says: "Si ad locum, ubi vomica percussionis signo delecta est, volans manus spuenti imposueris, strepitum puris manifeste distingues in pectore interno, idque dum tussiverit æger." "If one lays the hand over the spot where the percussion has indicated a vomica (pus cavity) and has the patient cough, he can clearly distinguish the rustling of the pus within the chest." "If, instead of the hand," says Clar, "he had said the ear, it would have been auscultation."

In distinguishing dropsy (pleuritic effusion) of one side of the chest, he says: "Besides the general signs of this disease, the affected side, if completely filled with water, is enfeebled and appears less movable during inspiration. In this case also the affected side yields nowhere the natural sound on percussion. If the chest is only half filled the louder sound will be obtained over the parts to which the fluid does not extend; and in this case the fluid will be found to vary according to the position of the patient, and the consequent level which the fluid attains." Under signs of hydropericardium, "The sound in the cardiac region," he observes, "which I have already stated to be naturally more obscure than in the other parts of the chest, is now as completely deadened as if the percussion were applied to a fleshy limb. A swelling is perceived in the precordia which can readily be distinguished by its superior resistance from the stomach distended by flatus."

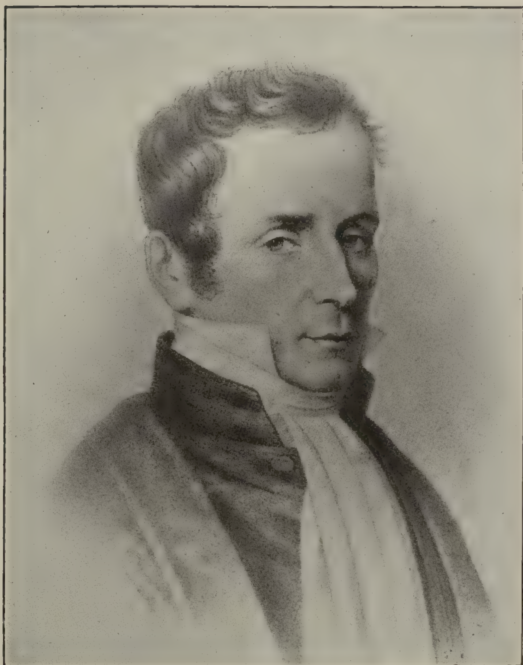
The foregoing extracts are enough to indicate the clear, orderly, and thorough manner in which Auenbrugger developed his discovery and established its principles and application by careful, painstaking, and repeated observations. "Scrispi illa quæ sensum testimonio inter labores it tædia iterum, iterumque expertus sum." Little wonder is it that he spent seven laborious years of observation and study in interpreting and applying the new evidence which percussion

had revealed to him. When one considers the state of things before the *Inventum Novum*—an entire absence of any definite and exact diagnostic method of determining and differentiating thoracic diseases, and that a group of symptoms or a single symptom was the sole datum for a vague diagnosis—he can perhaps realize the enormous advance which Auenbrugger's discovery of percussion and its development and application in the *Inventum Novum* made in the diagnosis of diseases of the chest. The mystery is that it remained so long unrecognized and unappreciated.

Corvisart, as I have said, was the discoverer of Auenbrugger, and, by his translation of the *Inventum Novum* and commentaries upon it, established percussion upon a firm basis, and extended its knowledge. He was also the teacher of Laennec, the discoverer of mediate auscultation; and thus by this happy coincidence united the two great discoverers, just as their discoveries are inseparably joined in practice. By his magnanimity and justice toward Auenbrugger, and his connection with Laennec, Corvisart's memory is indissolubly linked with theirs, and shares their immortality, when it might have gradually sunk into forgetfulness if dependent upon his own attainments, as illustrious as these were. Thus virtue has its reward.

While Auenbrugger was spending the latter years of his life in the quiet pursuit of private practice in Vienna, Laennec, all unknown to him, was growing up at Nantes and Paris, developing his acute intellect, which, nine years after Auenbrugger's death, was to give to the world the momentous discovery of mediate auscultation, which should forever be the complement of percussion. One wishes that the two men might have been contemporaries and known each other. A mutual friendship would have been sure to have followed, they were so much alike in personal character and professional enthusiasm.

René Théophile Hyacinthe Laennec was born at Quimper, lower Brittany, France, February 17, 1781. His mother dying of consumption when he was five years of age, his father,



RENÉ THÉOPHILE HYACINTHE LAENNEC.

(From the *Practitioner.*)

for some reason or other, placed him under the care of an uncle who was the rector of the parish of Etian. His guardian, soon after being promoted to another field of labor, transferred his charge to another uncle, Guillaume François Laennec, a physician and man of eminence at Nantes, and a professor in the medical school there. He became a veritable father to the boy; gave him a sound and thorough education in Latin and Greek, and at an early age excited in him a love for the exact sciences and observations. So what seemed at first to be a misfortune proved a great good fortune, not only for Laennec himself, but for the world. If he had remained with his father or his uncle the rector, he might have been a lawyer or a priest. No doubt he would have achieved distinction in either profession, but the world would have had to wait longer for mediate auscultation. He received his early medical education under the direction of his devoted uncle, and at the age of nineteen, in 1801, he went to Paris to complete it, where he entered the service of Corvisart at the Hôpital la Charité.

Laennec took his doctor's degree in 1804, at the age of twenty-four. He had been a most industrious student, and during his first three years at La Charité he drew up a minute history of nearly four hundred cases of disease. After entering upon the practice of medicine he continued with unabated zeal his studies and observations; became the editor of the *Journal de Médecine*, and lectured upon pathological anatomy to investigations in which he continued to devote himself. He also wrote various monographs, as he continued to do during his professional life. In 1816, at the age of thirty-six years, he was appointed chief physician to the Necker Hospital, and soon after entering upon his duties he made the discovery which immortalized his name.

One day, while traversing the court of the Louvre, he perceived some children amusing themselves by applying the ear to the two extremities of a long beam or piece of wood, and transmitting reciprocally the light sound arising from the blow of the finger against the opposite end. In the intermediate space no sound was perceptible. Laennec reflected upon this,

and some days after, on being consulted by a young woman persenting the general symptoms of cardiac disease, with whom percussion was unsatisfactory on account of her stoutness, and her age and sex prohibiting the direct application of the ear to the chest, he recalled the children in the court of the Louvre. Immediately he took a quire of paper and made a tight roll, one end of which he applied to the chest of the young girl and the other to his ear. With delight he found that in this way he perceived much more plainly the beating of the heart. Thus, as Chereau[1] says, the sport of the children and respect for modesty are two facts which played a part in the discovery of mediate auscultation.

When profound knowledge in any branch of learning exists and genius is present, the discovery is not far distant, and any seeming trivial event may disclose it. As Richardson[2] well says, "How truly trifling a circumstance may be the vital circumstance which such men disclose, from what to men unendowed with the finer faculty are mere passing incidents!" "What millions of physicians," he continues, "must have attended millions upon millions of chest diseases between Hippocrates and Laennec; physicians, learned as Galen, wise as Sydenham, keen as Morgagni! And yet Laennec was the man and mind wanted to make or rather complete a discovery that had been lying ready for birth some thousands of years. It waited for the fat young lady with heart disease whose chest could not be touched by ears polite, for the quire of paper that admitted of being rolled into a tube for listening through, and for this man Laennec to do the part of thoracic eavesdropper."

Laennec devoted two years in testing and developing his new discovery. One can but faintly imagine the unspeakable delight which he must have experienced as he found himself enabled to clearly determine various pathological conditions of the heart and lungs, previously obscure and undetermined. How eagerly he must have hurried to his hospital clinic each

[1] Dr. A. Chereau. Laennec, Archives Générales de Médecine, 7th Series, 4, 1879.
[2] Laennec, by Benjamin Ward Richardson. The Asclepiad, 5, 1888.

day, and rejoiced to find there a new case of thoracic disease! His patient and untiring industry of the previous years in the study and observation of disease was all unwittingly preparing him to utilize at once his discovery. The tool fell into trained hands ready to produce with it the perfected result.

In 1818 he communicated his discovery to the Academy of Sciences, and a committee of three reported in complimentary terms upon it, but without enthusiasm. In the succeeding year, 1819, he published his immortal *Traité de l'Auscultation Médiate.* After referring to the incident which led to the discovery, he says: "I forthwith commenced at the hospital Necker a series of observations which have continued to the present time. The consequence is that I have been enabled to discover a set of new signs of disease of the chest, for the most part certain, simple, and prominent, and calculated, perhaps, to render the diagnosis of diseases of the lungs, heart, and pleura as decided and circumstantial as the indications furnished to the surgeon by the introduction of the finger or the sound in the complaints wherein they are used."

Time has proved to be true all he claimed, and, as Dr. Stokes says, "The introduction of auscultation and its subsidiary signs was one of the greatest boons over conferred by the genius of man on the world."

Laennec said nothing new upon percussion, nor did he ever describe all the results indicated by Auenbrugger and Corvisart; but, as Mailliot says, he was entirely absorbed in auscultation; still, in his chapter upon its use, he very fairly estimates its value and speaks appreciatingly of its discoverer: "One of the most valuable discoveries ever made in medicine."

At first he was not inclined to give a name to his new instrument, but, finding that others were suggesting various ones, he happily fixed upon the euphonious one it now bears. He describes it as follows: "A wooden cylinder, an inch and a half in diameter and a foot long, perforated longitudinally by a bore three lines wide, and hollowed out into a funnel-shape to the depth of an inch and a half at one of its extremities.

There is a stopper or plug which can be inserted into its excavated extremity, thus rendering it a simple cylinder. It is divisible in the middle of its length by a screw, partly for the convenience of its carriage and partly to permit its being used of half the usual length." The simple tube being used for the heart and voice, and, with the plug out, for exploring respiration and rhonchi.[1]

Of the treatise itself you are doubtless all familiar and can attest the truth of Dr. Addison's[2] averment that it will ever remain a monument of genius, industry, modesty, and truth. "It is a work," he continues, "in perusing which every succeeding page only tends to increase our admiration of the man, to captivate our attention, and to command our confidence. We are led insensibly to the bedside of his patients; we are startled by the originality of his system; we can hardly persuade ourselves that any means so simple can accomplish so much, can overcome and reduce to order the chaotic confusion of thoracic pathology; and hesitate not in the end to acknowledge our unqualified wonder at the triumphant confirmation of all he professed to accomplish."

A brief reference to his conclusions upon the curability and treatment of phthisis may be interesting as showing how nearly in accord he was with present-day opinions: "The cure of consumption," he says, "when the lungs are not completely disorganized, ought not to be looked upon as at all impossible, in reference either to the nature of the disease or of the organ affected." "The pulmonary tubercles differ in no respect from those found in scrofulous glands; and we know that the softening of these latter is frequently followed by a complete cure." After reviewing the various cures suggested (a motley crowd of them)—bleeding, the actual cautery, issues, blisters, mineral waters, purgatives, balsamics, vapors, the air of cow-houses, inspiration of different gases, mercurial salivation,

[1] Through the kindness of Dr. V. Y. Bowditch, one of Laennec's original stethoscopes (used by him) was exhibited. It was the property of Dr. Henry Bowditch, and left by him to the Warren Museum of the Harvard Medical School, where it now is.

[2] Hudson. Laennec, British Medical Journal, ii. 1879.

emetics, acorns (roasted or raw), charcoal, different kinds of mushrooms, crabs, oysters, frogs, vipers, and chocolate—he finally concludes by saying, "that, although the cure of tuberculous phthisis be possible for nature, it is not so for medicine." In order to make a direct attack upon the disease, he says: "We ought probably to be able to correct an unknown alteration in the assimilation or nutrition. Of all the measures hitherto recommended for the cure of phthisis, none had been followed more frequently by the suspension or complete cessation of the disease than change of situation." In one of his hospital wards he tried the experiment of establishing an artificial marine atmosphere by means of fresh sea-weed, suggested to him, doubtless, by the wholesome sea-air on the coast of his native Brittany. His statements, based upon accurate and abundant observations, carefully analyzed and verified by dissections, and illustrated by frequent histories of cases, are admirable illustrations of the finest kind of scientific medical writing. His style is simple and lucid. "The fundamental truths presented by the discoverer of auscultation," says Dr. Flint, Sr.,[1] "not only remain as the basis of the new science, but form a large portion of the existing superstructure. Let the student become familiar with all that is now known upon this subject, and he will then read the writings of Laennec with amazement that there remained so little to be altered or added."

After the publication of his treatise Laennec's health was so impaired that he was compelled to give up his work and retire to his native province, and, as one of his biographers expresses it, "escape his glory." He had completely exhausted his limited supply of physical force, and suffered from extreme depression of spirits, which not infrequently follows excessive mental application. With freedom from care and labor, and an outdoor life amidst the delightful associations of childhood and youth, he gradually wooed back a moderate degree of health, and at the end of two years returned to Paris,

[1] New Orleans Medical News, 1859-60, vi. p. 736.

"solely influenced," says Forbes, "by the idea that he might be of use to mankind by extending the knowledge of auscultation." It is quite possible, too, that he thought of the fate which had befallen Auenbrugger's discovery until Corvisart shook the dust from it. It was a fatal step, as the sequel proved, and it seems to me doubtful if his subsequent labors, particularly in the revisions and additions to his treatise, added materially to his great achievement as so exhaustively unfolded in the original edition of his work; but his courage was admirable and his motive noble and unselfish.

It was in the year 1821 that he returned to Paris, being then forty years of age. The following year he was elected professor of medicine in the College of France, and in 1823 professor of clinical medicine at the Hôpital la Charité, where, nearly twenty years before, he had been a medical student under Corvisart. Students and physicians from France and other countries flocked to his clinics, and through them mediate auscultation became widely known and popularized. In his clinic at la Charité he was teaching the medical world, and herein he had an immense advantage over Auenbrugger, who was never a clinical teacher. Besides his exacting hospital labors he resumed his private practice, became physician to the Duchess of Berri, and began a revision of his treatise on auscultation, which was so complete that it almost seemed a new work. No man with his impaired and delicate constitution could endure the strain of such excessive and continuous work, and in the midst of the revision the break came. By a heroic struggle he managed to complete it, and then his labors for this world were at an end. "After having uselessly employed two bleedings and some other means," as one of his contemporaries says, "and seeing that he grew more and more feeble and thin," cough, fever, and other distressing symptoms supervening, he set out again for Brittany, hoping that his native air and soil might once again prove beneficial, instinctively feeling that if anything could revive him it was kindly nature as expressed in outdoor air, familiar scenes, and restful life, rather than bleedings and potions. Infinitely pa-

thetic was his endeavor to show that his physicians were mistaken in their diagnosis of pulmonary tuberculosis, when the symptoms of the disease were so evident, as he himself would have quickly recognized in one of his patients. His death occurred August 13, 1826, at the age of forty-five. He was married two years before, but left no descendants.

There stands in the Cathedral Square at Quimper, Brittany, a statue of Laennec erected in 1868. The illustrious physician is represented clothed in official costume, sitting, holding in his right hand a stethoscope, while he raises the left as in the act of a demonstration. Upon it is the following inscription:

A l'inventeur de l'auscultation,
Laennec, René-Théophile-Hyacinthe,
Né à Quimper, le 12 février 1781,
Mort à Plouaré en 1826;
Professeur à la Faculté de Médecine de Paris
et au Collége de France,
Membre de l'Académie de Médecine."

Ce monument a été élevé
par l'Association générale des Médecine de
France, par la Bretagne,
et par les Médecins français et étrangers, 1868.

In personal appearance Laennec was small of stature, had fine clear-cut features, a refined and sensitive mouth, extremely delicate complexion, and keen eyes. He was of a nervous temperament, and physically was never robust, although he accomplished such an enormous amount of work. He was simple and abstemious in his habits, especially in eating, and ordinarily was never very long at the table. "He was mild and agreeable in his manners, and of a quiet and even temper." Ardent passions were unfamiliar to him. He possessed firmness, and was tenacious of his opinions. Like most men of his calibre, he was humble and kind-hearted, which was in no degree lessened by his great reputation and the deference paid to him in the later years of his life. He used to ride to the hospital in a modest hired cab, and his dress was always

the same—short breeches, a black coat, and white cravat. When, however, he paid a professional visit to the Duchess of Berri or Cardinal Fesch, whose physician he was, he wore, according to the custom in making such visits, a dress coat, a regulation chapeau, and a ceremonial sword.

In spite of his feeble constitution, he was a great lover of the chase, and in the season he used to go out to the parks in the suburbs of Paris and indulge in this sport. In the winter he would amuse himself by shooting at a target with an air-gun in his apartment. He was fond of music and played upon the flute, his fine, delicate lips enabling him to obtain a good tonguing. This knowledge of music and the power which it gave him of making fine distinctions in differentiating respiratory sounds and vocal resonance must have been invaluable to him in developing his discovery; in his treatise he refers to certain flute sounds to illustrate his meaning when speaking of the pectoriloquy of large excavations. In one corner of his apartment he set up a lathe and amused himself in turning objects, and used to make his own stethoscopes.

"The rich," says his contemporary Bayle, "he frequently refused to visit on account of the bad state of his health, but the poor never; nor was it only in the way of professional advice that he served the poor; he was extremely liberal in relieving their distress with pecuniary aid, and in a manner so unostentatious that it is only since his death that the extent of his bounty has come to light. He was never greedy after practice for the sake of the money it would bring him. His private practice is said to have brought him about twenty-five thousand francs a year."

He had fixed religious principles which he did not conceal, and his death, says Bayle, was that of a Christian. As Flint says, "His life affords an instance, among many others, disproving the vulgar error that the pursuits of science are unfavorable to religious faith."

Laennec's whole life was so absorbingly devoted to professional pursuits that there was little time or strength left for anything else; and yet such an active mind as his could hardly escape

knowing something of other departments of knowledge. Latin and Greek he knew to perfection, and was accustomed to conduct his clinics in the former language, and sometimes to correspond in it. "Laennec's genius," says Forbes, "was decidedly inventive, and his turn of thought original." He was a consummate student in the art of observation and possessed "profound knowledge of organic diseases," and "was remarkable for his diagnosis of them in the living body." "In the diagnosis of diseases of the chest he was universally allowed to be without a rival." Forbes thinks he did not possess in a high degree the mental qualifications necessary to constitute a great and skilful practitioner; perhaps he did not, nor does it so much matter; many men of lesser ability could be good practitioners, but a discoverer, teacher, and investigator of Laennec's capacity appears but seldom.

He was absolutely true and unselfish in his professional aims. To improve his art, to seek truth in it whenever found, to establish the diagnosis of disease upon the sound basis of pathological anatomy and accurate observations, and to extend the knowledge of his new discovery; this is what he labored for. In brief, the impelling motive of his life was, as Flint says, "a love of truth for its own sake, and a desire to be useful to his fellow-men"—the ideal and aim of a lofty soul. His courage in continuing his labors in weakness and suffering was superb and heroic. How fine the struggle to complete the second edition of his treatise!

There is something pathetic in the loneliness of Laennec's life so far as social and domestic relations were concerned, as contrasted with that of Auenbrugger's. His daily home-coming after his arduous duties at the hospital must have been a rather dreary one, with no happy greeting of wife or children; but he was so absorbed in his work that we may suppose he did not consciously miss what he had never had. Nor do such men as he care much for social distractions; the physician is ever intimate with life and human nature in all its infinite variety.

Laennec, as I have said, published various papers, reviews,

and criticisms, the most of them written in the early part of his life; the most noteworthy, perhaps, being a treatise on the melanoses, one on encephaloides, one on pathological anatomy, an essay on angina of the chest, and a description of the anatomical condition of the lungs in emphysema. Of this latter, Rokitansky said that had Laennec done nothing more it would have been sufficient to render his name immortal. "His writings are generally marked," says Forbes, "by sound sense, clear views, and perspicuous order."

Such was Laennec's life, and such his contributions to the advancement of his art. To few in our profession, or in any other, is it given to add so much to the sum total of the existing knowledge upon the subject of their labors. To all of us, however, it is permitted to maintain the same exalted attitude toward our profession, and a readiness to increase, if happily we may, the knowledge of it, however humble the contribution may be. The greatest honor any of us can pay to the memory of such men as Auenbrugger and Laennec is to emulate their lofty example.

I trust it may not have been without interest to you to have reviewed with me the lives of these two illustrious men, whose discoveries have made it possible for us, as I said in the beginning, to exist as an association especially devoted to disease of the thoracic cavity. In the ever-increasing mass of medical knowledge to become familiar with, but little time or opportunity is left for the study of medical biography, but, as Dr. Flint says, "The contemplation of the lives of worthy brethren who have gone before us is well calculated to stimulate our zeal, guide our aims, encourage us to perseverance, and increase the attachment to our calling." "Who can doubt," he continues, "that it is the order of Providence for the illustrious dead to serve as shining lights for the living! To illumine the paths of those who are to follow in their footsteps was part of their mission. This thought should stimulate the desire to live beyond this bodily existence, in the cherished remembrance of mankind. It is a noble and virtuous ambition to strive thus to survive on earth the brief term of mortal life."

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COMMON ERRORS OF GENERAL PRACTITIONERS IN DEALING WITH CASES OF PULMONARY TUBERCULOSIS.

By FREDERICK I. KNIGHT, M.D.,
BOSTON.

The errors of which I shall speak are well known to the members of this Association, and are encountered by many of them daily, and it would be an improper use of the time of the Association to weary it with a long discourse upon them; but I thought that they might be diminished by briefly calling attention to them here, if my remarks should be indorsed in the discussion by members of the Association.

1. The first error to which I shall call attention is the failure to make an early diagnosis. An early diagnosis is not usually difficult since the discovery of the tubercle bacillus. Failure to make it, however, may be very serious, as it is especially true of this disease that the earlier its presence is discovered the more amenable it is to treatment; whereas, if there is delay till the disease is self-evident, and perhaps secondary infections have taken place, there is not much chance of restoring the patient to health. The most striking results of treatment of pulmonary tuberculosis in the great open health resorts, and also in sanitaria, are in patients who present all the outward aspects of health from the start, who have never appeared as invalids.

Why is it that there is so often a failure to make the diagnosis early in those cases most promising of cure if taken in hand promptly—viz., those with morning cough and expectoration, but no fever or other general symptoms? The rea-

son is that the patient naturally makes light of it, and perhaps contents himself with asking the doctor on the street for a prescription for a little cough, and this may be repeated several times without any suggestion of examination on the part of the physician, or until the patient looks and feels sick.

Another reason is that the physician may be the personal friend as well as medical adviser of the patient and shrink from a knowledge of the results of a physical examination. This is also sometimes true in the case of a physician and a member of his own family.

The patient naturally considers a slight dry cough as due to some throat irritation, and a little hæmoptysis as coming from the same region; but he should not be encouraged in this idea, as is too often the case, by the physician. Any cough should necessitate frequent examination of the chest and sputum until the soundness of the lungs is proved by long acquaintance. Hæmoptysis very rarely comes from any lesion of the throat, but usually from the bronchi.

Another mistake is to neglect to pay proper attention to fever, the physician very likely coinciding again with the patient that he has a "touch of malaria." Time and again have I seen patients with a dry cough, chills, and fever, not at all of malarial type, however, allowed to go on for weeks and months taking quinine, and no physical examination suggested.

2. A second error is the failure to admit the gravity of the situation the moment it is discovered, and to put the patient at once in the best possible condition for recovery. Niemeyer used to say that the danger of a consumptive patient was "that he become tubercular." In the light of modern pathology I should say that the danger of a tubercular patient is "that he become consumptive"—*i. e.*, subject to secondary infections.

Unfortunately, too many physicians wait until the patient is consumptive, and then perhaps recommend expensive treatment, which is almost surely useless. It is better, as a rule, that the patient also should be fully informed of the gravity

of the situation, as in this way only will he give thorough co-operation in the effort for his recovery. Of course, he should be fully impressed with the hope of recovery if the proper course is pursued.

3. A third error is, while temporizing, in recommending treatment not only useless, but positively injurious. Giving medicines which take away the appetite and interfere otherwise with digestion does a great deal of mischief. Cough syrups, cod-liver oil, and creosote do a large share in hastening the decline of patients. If any sedative is required it should be given in as simple a form as possible and without syrup. I do not mean to say that cod-liver oil never does good, for there are patients who can take and assimilate it with ease, and greatly to their benefit; but it is cruel to prescribe it in a routine way without selecting cases and watching effects. Who has not many times seen patients with thickly-coated tongues swallowing large doses of oil faithfully three times a day, eructating it all the time, and capable of assimilating neither that nor any other food? Neither do I deny that creosote does good in some cases in modifying the bronchial secretion and improving digestion; but I believe that large doses, as a rule, take away the appetite and do more harm than good. It, like cod-liver oil, should be administered tentatively.

Another unfortunate mistake is often made in giving a general unrestricted order to "drink whiskey" as a preventive of consumption. The injudicious use of alcoholic stimulants, by depressing the vital forces, not only makes the patient irritable and dissatisfied with himself and everybody else, but very seriously interferes with his recovery.

Many patients also are seriously injured by being told to exercise when they should be kept quiet. This pertains especially to patients in a febrile condition.

4. A grievous error is often committed in the matter of sending patients away from home. Sometimes those are sent away who have only a few weeks or months to live. Such patients in almost every case would naturally be better off at

home. Others are advised to change climate who cannot possibly afford to remain away from home long enough to do any good. They go away, live in miserable quarters, on poor food, and, having spent all their money in a short time, are obliged to return. They naturally would have spent their little money to much better advantage at home.

Insufficient care is exercised in advising patients who *are* able and fit to make a change as to the selection of a climate. Too often the advice is simply to "Go South," or "Go West." In such cases the patient often flits about from one climatic condition to another, without staying long enough to fully experience the modifying effect of any one, perhaps till the chance for beneficial action is past.

5. The last error, a very grave one also, to which I shall call attention, is allowing the patient to go without sufficient medical supervision. This disease, like any formidable enemy, requires constant watchfulness, to help gains promptly, and as promptly to stay relapses. The general practitioner himself is apt to fail in this because his attention is absorbed in critical acute cases; but he also fails to place his patients in proper medical care when he sends them away, whereas the presence of a physician skilled in treating such cases should often determine the selection of a residence for the patient.

These are a few of the more serious of the errors in dealing with cases of pulmonary tuberculosis, by means of which hundreds of lives are sacrificed which might have been saved. Therefore, it becomes us to iterate and reiterate our warnings as long as they continue to exist.

SUGGESTIONS: THE RESULT OF RECENT EXPERIENCES WITH PHTHISICAL PATIENTS.

By VINCENT Y. BOWDITCH, M.D.,
BOSTON.

Even at the risk of being accused of "bringing coals to Newcastle," I venture to give you a few thoughts which have occurred to me of late, the result of experiences which I deem worthy of record.

Not only in my private practice, but in my connection of late years with the Sharon Sanitarium for Pulmonary Diseases, at which place the express stipulation for entrance is that the cases shall be strictly in the "incipient" form, in which the tubercular symptoms are *just beginning* to show themselves, I have been frequently impressed with the fact, when patients have been sent for examination, that one or two of what I believe to be the most important features in diagnosis, or rather prognosis, have apparently been overlooked by the physicians in attendance. It has, therefore, seemed to me worth while to lay special emphasis upon these points at one of our meetings, hoping thereby to give that additional weight which comes from the utterances of an association whose work is known to be in special directions.

It is a comparatively easy task to make the diagnosis of pulmonary tubercular diseases, even in the early stages, where the physical signs are definitely marked and the general symptoms are those so familiar to us all; but in those cases in which the signs, such as dulness upon percussion, changes in the respiratory murmur, and even râles, are lacking, our

powers of diagnosis and prognosis are often taxed to the utmost. It is in these latter cases that I have frequently found the general practitioner has not paid sufficient attention to what I deem the most important symptoms—viz., the quality of the pulse, the temperature, and the condition of the digestive organs. Very often I have had cases sent to me as suitable for treatment, with a hope of arrest of disease, because of a lack of definite physical signs in the chest beyond possibly a few sparse râles or slight change in the respiratory murmur. I have been obliged, however, in these cases to give a very grave prognosis, and have been unable to receive them as patients at the Sanitarium simply because a weak, rapid pulse, more or less elevated temperature, and poor condition of the stomach tell me that there is without doubt disseminated tubercular disease, even in the lungs, which renders the case a most unfavorable one for treatment, usually showing after death the almost universal dissemination of tubercle, without, perhaps, marked breaking-down of tissue.

It has been said by some one that he would prefer to treat a patient with two bad lungs and a good stomach rather than one with one bad lung and a poor stomach.

While making due allowance for the more or less sweeping character of all such epigrammatic statements, it has the very element of truth which I am endeavoring to emphasize. The importance of recognizing the unfavorable character of the cases I have mentioned cannot be overestimated, for it may make all the difference in the world to the poor patient as to whether he shall, under such conditions, be advised to go, for instance, to Colorado or other distant health resorts with the chance of aggravating some of his most distressing symptoms, or, better, advised to make a less radical change and remain nearer home and friends.

I feel confident that those of our members here who live in the more noted health resorts will, from their experience, support me in emphasizing the importance of recognizing these facts, which affect the whole future welfare of the patient.

In a word, then, a rapid, feeble pulse, fluctuating tempera-

ture, dyspnœa, a pasty or dusky complexion, and a poor digestion are symptoms very frequently, if not usually entirely, inconsistent with a truly *incipient* form of pulmonary disease, even when the physical signs in the chest are very few or even entirely lacking under the ordinary method of examination by auscultation and percussion. Such symptoms, moreover, should militate strongly against the advice usually given for cases of true incipient phthisis, more especially against those forms of treatment which involve radical changes of climate away from home and friends.

I now wish to refer to a subject upon which I have already written a short paper prepared for, but not read at, the meeting of this Association two years ago at Lakewood.[1]

A short time previous to that meeting I had been so astounded and stirred by statements made not only by laymen, but by some physicians, at the State House in Boston concerning the proposed abolition of two most useful institutions for consumptives in the suburbs of the city, that I felt I must protest against what seemed to me the extravagance of what was said and done at that time.

What I dwelt upon then was chiefly the fact that in our enthusiasm for the results of recent bacteriological work we are in danger sometimes of forgetting the patient's position, and, in our desire to prevent the spread of disease, are oblivious of the fact that by sweeping, unguarded assertions we are not only creating a spirit almost of terrorism among the friends, but are causing mental anguish to the phthisical patient himself, who feels himself a leper, a constant menace to the health and comfort of those he loves.

I cannot think I am alone (in fact I know I am not) in having instances of the unreasonable, sometimes brutal, behavior among friends of patients, founded upon an exaggerated fear, as I deem it, of the infectious nature of tubercular disease, which we have been taught loses its chief source of danger when moderate measures are used for the prevention of infection.

[1] "A Plea for Moderation in Our Statements Concerning the Contagiousness of Phthisis," Boston Medical and Surgical Journal, 1896.

Let me cite an instance: A young, sensitive girl, who had undoubted symptoms of tubercular disease, enlarged glands, cough, slight expectoration, containing bacilli, etc., after a prolonged stay at Sharon, was enabled to return to her home and take up some light occupation. Soon after the mother came to me in distress, with the following history: She had found her daughter sitting at a table alone, very pale, with a letter upon the floor at her side. Upon asking her what was troubling her, she finally only said, "Mamma, I am a leper," and handed her the letter from a member of the family, who had formerly been very kind to her, and to whom the girl had written that she "was so well now that she should soon go to see her." The mother showed me the letter, and I read, "On no account whatever must you ever enter my house again; you are a source of danger to everybody." I can let you imagine the effect of such brutal words to a young, delicate girl. A subsequent letter, in answer to the mother's indignant reply, said, "The highest authorities tell us this is a very infectious disease, and I must think of my child."

This is only one of many similar instances in my own practice and that of others. It may be said that the physician's function is merely to point out the truth as far as he knows it, and that he cannot control the selfishness and brutality of those with whom he comes in contact. Very true to a certain extent, but I maintain that we are losing sight of one of the highest and noblest functions of the ideal physician if, in giving our rules for the protection of the well, we do not use caution in our statements founded upon recent comparative experimental work, and fail to inculcate at the same time that spirit of kindness and thoughtfulness for the feelings of the sick which humanity demands.

I trust that I shall not be misunderstood, as I stated in my previous paper on this subject. No one could possibly feel a greater respect than I for what bacteriology has taught us already and for what is still in store for us from that source; no one could possibly feel the importance more than myself of teaching patients and their friends the paramount importance

of absolute cleanliness about the phthisical patient, of the careful disposal of the sputa, and attention to the general health of those in attendance; but I maintain that this can all be wisely and kindly done without causing, as a rule, this spirit of terrorism of which I have spoken, and without making such sweeping and unjustifiable statements as that "all homes for consumptives are a source of danger to the surrounding community," however regulated, and other equally, to my mind, false assertions. Let us keep in mind, moreover, that in getting the *juste milieu* of every question the pendulum swings far in both directions, and the history of medicine shows us plainly that in no other profession or walk of life do we have to proceed so cautiously as in ours before finally accepting new theories, enthusiasm for which carries us at first into extreme statements, which afterward often have to be greatly modified, if not entirely retracted.

Of late we are confronted with another statement, made by Flügge,[1] of Berlin, regarding the possibility or probability of bacilli being carried in small droplets of mouth-fluid into the air during the act of coughing. He maintains, moreover, that the chief danger of infection comes from these suspended droplets with bacilli in them, and not from the dried sputa, as we have been taught hitherto by Cornet and many others.

Up to a comparatively recent period, owing to numberless experiments by competent men, our belief has been that the expired breath has no dangers unless, as in violent coughing, small particles of sputum happen to be expelled; but this statement would carry us still further and make us believe that even with the destruction of the sputa we are still exposed to what Flügge believes to be the chief source of danger. We are in search of truth at whatever cost, and if it can be proved that Flügge's statements are based on facts we may be obliged to change our present views, but we are justified in waiting for further proof before accepting this extreme theory.

To the courtesy of Dr. J. J. Curry, U. S. A., late of the

[1] Deutsch. med. Wochenschrift, October 15, 1897.

Boston City Hospital Pathological Department, I am indebted for the manuscript of his paper, read before the Suffolk District Society in Boston last spring, and published in the *Boston Medical and Surgical Journal,* October 13, 1898. In this he gives the results of some experiments made while associated with Prof. Edwin Klebs, at Citronelle, Ala., last winter. Although granting that the number of experiments is small, he judges from his experience thus far that, although very probably bacilli are found in a certain number of the small droplets expelled from the mouth during hard coughing, and that hence certain precautions are wise, yet he believes that the dangers spoken of by Flügge are greatly overestimated. It would seem probable, too, with the now well-known experiments of Cornet and others in Europe, and of Hance, Gardiner, and many others in this country, upon the dust taken from rooms in sanitaria, hotels, hospitals, etc., that the danger from spread of disease by these droplets in the expired breath alone must be extremely small when it has been shown many times that in those rooms where spitting on the floor was prohibited and proper cleanliness enforced, the number of bacilli found in the dust was practically nothing; and, again, I ask for caution in accepting, still more in promulgating, this latter idea with undue haste.

I ask this especially from the following fact, another illustration of the rapidity with which many of the laity seize upon a statement made by physicians, and of the state of nervous apprehension into which many are thrown thereby.

Several months ago my attention was first called to Flügge's statement by a patient who came to inquire if I felt there was danger to his daughter from the *cough* of a young lady living not very far from his own house in the country, of whom his daughter saw little or nothing. Except for his evident nervous anxiety, it was hard to be serious in my reply: that I thought that the danger amounted practically to nothing; but on asking him why he entertained this idea, he said he had read in one of the Board of Health Reports of a neighboring State a remark or quotation which led him to believe that there was

ground for his apprehension. Later, upon reading the quotation to which he referred, I found it to be the statement of Flügge, which apparently the Board of Health of his State had immediately accepted and stated as a fact, a position which, with our present knowledge, is, to my mind, unjustifiable.

To hide plain proved facts for the sake of temporary comfort I regard as wrong absolutely; but that these facts may be made known wisely and without creating terrorism, with a minimum of mental suffering to the one most concerned, I believe to be perfectly possible in most cases. I speak now from the point of view of the practitioner, who naturally comes in contact with these different phases of human nature more than those whose work lies in the laboratory. The practising physician can note better than any one else the dire effect of the state of nervous apprehension into which so many are thrown by fear of disease. He also sees the mental suffering given to many a poor consumptive who, by the exaggeration of others, has been made to feel himself an outcast. He learns in both instances the wisdom of guarded speech.

In closing, let me recall Koch's own words, quoted in that most admirable essay on the "Prevention of Tuberculosis," by James B. Russell, of Glasgow, and reprinted for general circulation by the Massachusetts State Board of Health, an essay that should be read by every medical man. In fully recognizing the utterly different elements which enter into cases of phthisis as compared with other infectious diseases, he says in the closing words of his famous treatise: "It seems to me the time has now come to adopt prophylactic measures against tuberculosis. But, owing to the wide distribution of the disease, all steps taken against it have to deal with the social relations, and it must be, therefore, carefully considered in what way and how far we may proceed without neutralizing by unavoidable disturbances and other disadvantages the benefit obtained."

Let us be careful then in promulgating the theories of those whose work hitherto has gained our confidence and whom we

regard as teachers and leaders in our profession, lest in our zeal we go much farther then they themselves intend, and in so doing injure rather than aid the object we have in view.

DISCUSSION.

Dr. R. G. Curtin: I have been very much pleased with Dr. Knight's remarks in regard to the old-fashioned treatment of tuberculosis. I delivered a lecture at the Philadelphia Hospital about six years ago with very much the same trend as that of Dr. Knight's. In regard to the improper medication of consumption, which Dr. Knight spoke of, I am reminded of a conversation I had with a doctor in Philadelphia two or three years ago, who said to me: "It is a strange thing that my patients seem to get along better without medicine than with it." I suggested that perhaps it was the manner in which they were medicated. In answer to an interrogation, he told me that he gave them hydrocyanic acid, cyanide of potassium, opium, morphia, syrup of ipecac, and cod-liver oil. I told him that if he would modify his treatment and give tonic stimulants, perhaps they would get along more satisfactorily.

The sending away of patients has already been alluded to by Dr. Didama. Doctors are not always to be blamed for sending patients away in the last stages. You tell a patient in the fall of the year to go away, but he does not make up his mind to go till the next spring. When he finally concludes that he must do something, he is then, perhaps, in the condition to stay home; you are not responsible for the delay, as you ordered him away at the proper time.

Dr. J. H. Musser: I can scarcely add to the remarks that have been made on the very interesting and important subjects which have been treated of. The papers contain truths which should be constantly reiterated, and Dr. Curtin well remarks that we are not always to blame for patients going far to climatic resorts who are not in the condition to go. Too often, unfortunately, because of the knowledge of the value of climate, patients and families take lives into their own hands, and, in spite of advice, go to distant resorts. No doubt, however, a great many of us have erred from time to time, because it seems to me there is nothing more difficult in medicine than to decide in certain classes of cases what cases shall be sent away and what cases shall be retained. I have no doubt that Dr. Hart can give us incidents of a number of cases dropped into Colorado, sent there by Eastern physicians. Nevertheless, there are some cases

which we must send away for reasons that present all the contra-indications at the time for such steps. I recall one instance, the case of a young man who was taken ill with localized tuberculosis with marked systemic symptoms. Certainly there was excessive consolidation at the apex, and the man had high fever, rapid emaciation, sweats, etc. I advised, notwithstanding his weakness and fever, that he attempt to get to the Adirondacks, because our heated term in Philadelphia was approaching. He took my advice, although it was given with great misgivings. He put himself under the care of Dr. Trudeau, who told his mother he did not believe he would live ten days or two weeks in that region. Nevertheless, a residence of nine months under the care of Dr. Trudeau resulted in a complete cure, at least an arrest of all manifestations of the disease. It occurred three years ago, and he is perfectly well and strong, and is attending to his duties in Philadelphia at the present time. This was a case which, to all intents and purposes, we should never have thought of sending away, and yet, because of the conditions he would have been surrounded with in his home, at the time I thought it advisable to take the step, and, fortunately for us all, the result justified the means. There are others of such cases that we have to debate about, and sometimes rely rather on giving our patients the benefit of the doubt regarding climatic treatment, although inwardly probably believing that it is not right to resort to such measures. Sometimes, too, we have to send them away, or give our assent, in order to treat the individuals, the other members of the family. I know very well that a mother with an ill child depressed to an extreme degree, perhaps never regaining health, would soon die of a broken heart if climatic treatment had not been resorted to for her child. Really for the sake of the family, sometimes the patients have to suffer. Fortunately in the case alluded to his digestion was good and he was able to take nourishment. I believe the antecedent family history was good; but, curiously enough, his mother died eighteen months after with tubercular meningitis.

Dr. James A. Hart: I do not know that I can add anything to what has been said. Drs. Knight and Bowditch have said just exactly what I wanted to hear, and I feel well repaid for coming to the meeting. We have a great many patients sent to Colorado who, undoubtedly, would be better if left at home. They arrive there after a long journey, with high temperature, sweating, and so on, with every indication of advanced trouble, and in a number of instances I have found cavities, the patient about in the condition in which we should send one home. It is a very difficult matter for the physician at the health resort to manage these cases. They do not understand why they should be sent home because of this hopeless condition, which it invariably is.

There is another class of cases which are sent out and advised to rough it, ride horseback, and have a good time generally, and keep away from doctors. It is not long before they get into the doctor's hands, and they have taken a course they should not have taken, and we have a great deal of trouble in the management of these cases. I think, with Dr. Knight, that patients should be advised before sending away, but I do not think the advice should be to keep themselves under the care of their family physician at home after they go away.

Dr. T. D. Coleman: I feel, personally, very much indebted to Dr Knight and Dr. Bowditch for these two papers, for they do us all good. I have had in my own practice during the last year patients illustrating points brought out in both of these papers. One of the patients came to me from a neighboring city. He was convalescing from what was said to be an attack of typhoid fever. If the physical signs in the chest had not been sufficient to diagnose the case to be one of tuberculosis, the examination of the sputum would have done so, and there was little excuse for the diagnosis not being made. The patient was so far advanced that in the course of about six weeks he died. The early appreciation of these troubles I think is the key to the cure of them, and I feel that where a proper physical examination is made many of the errors will be avoided. It seems to me that the most valuable portion of my early training was that which taught me to make a thorough physical examination of all cases that came under my care. I have made this a rule of my life, and in that way I feel that I have avoided many errors of diagnosis.

Dr. Beverley Robinson: I share, of course, in the judgments that have been pronounced by Drs. Knight and Bowditch. I consider Dr. Bowditch's paper a valuable one indeed, because I have many times said what he has so ably stated here to-day. I think too often a mistake has been made and deficient attention paid by physicians and the public as to how much we should consider the feelings of the patients and the distress caused in the families, and, after all, it seems to me an advisable thing for the practitioner to give consolation and happiness rather than pursue too far independent measures based perhaps upon the most accurate scientific deductions of the day. I think that is the idea; possibly some of the reflex of what Dr. Bowditch has said, and I absolutely agree with all his statements and wish to say how much I appreciate his paper.

With reference to Dr. Knight's paper I wish to say that I disagree with some of the statements. I must say very frankly that whilst I agree that a great many individuals are not examined accurately enough, and the diagnosis not settled sufficienily soon, and proper and judicious treatment not followed up at all times as it should be, at the time most favorable, I must also say that with the better under-

standing of the disease, the better education of our medical colleges, and the decided improvement on the part of the men I come in contact with in making up the accurate diagnoses, I should be rather disposed to take sometimes the other side of this position which I understand Dr. Knight to assume, namely, that I find a good many people have their homes broken up, are sent away from home, or else led to believe that their tubercular condition is tolerably confirmed and certain, when a future consideration of the case some months later would lead one to believe that there had been an error on the other side, namely, a too confirmative opinion of the phthisical infection having been made and did not exist. Of course, we are all very well aware that when there is no marked fever, if any, or where there is no sputum, the bacilli cannot be found, we are all thrown back upon our physical examination, or else upon the rational symptoms presented.

Now, with regard to the physical examination, I am free to admit that although I have the greatest respect for all that has been told us to-day, that the best percussion and auscultation permits us to find decided errors and mistakes made; and some of us notice when we follow the post-mortem room that the different examinations made prior to death are not always upheld by the post-mortems

Now, in going back to the rational symptoms of phthisis, I must say that I think the symptoms to which Dr. Bowditch has referred whilst good and perhaps a thoroughly versed conclusion, even though the physical signs may be undetermined, even though there may be no sputa to examine, yet I think there is a certain liability to error. Once more I will say I have seen people where they have been sent away, homes broken up; they did not turn out to be phthisical patients. Therefore, I have not been willing to immediately indorse absolutely what Dr. Knight says.

Now, another point which is of some little value in regard to giving cod-liver oil in large doses. You have the patients with tongues coated, digestion disturbed, and it is very hard to give medicine or food under these circumstances. But we cannot throw up the sponge with regard to medicines or food. I must make a mental appeal, and at least hope and trust that we may have some things that will yet do for these poor people. I would refer, in this particular line of thought, to the fact that I have seen a certain number of hospital patients (I will not say private patients, for various reasons I have not been willing to pursue that method with those); I have fed a certain number of phthisical patients in hospitals with the stomach-pump when I felt they could not take food or medicine otherwise, and I have tried to hope I believed (I am stating it just as I feel it to be) I have produced a certain amount of temporary beneficial effect.

With regard to the question of climate I am particularly opposed

(begging the pardon of the gentleman from Colorado) to sending a patient far away if I can find conditions near home which will probably suit those patients about as well. I have a very doubtful mind as to the merits, with regard to the curative influence, of any particular climate as opposed to any other particular climate. I think you have to estimate all the conditions involved in the selection of a particular place, and I agree with Dr. Knight that it is important to have the good physician there. I always want to know a good deal about the drainage of the house, and the food, which, after all, make a sum quite as important as the question of climate. And I do not believe it is a good thing to send people so far away from home. I am speaking of the secondary stages.

I think that paper of Dr. Bowditch is a very valuable one, and I cannot express myself too strongly as to how far its influence may reach.

Dr. Knight: I would say a word in regard to Dr. Didama's remark about the use of syrups. I think in the treatment of these patients, as far as possible, the use of syrups and sugar should be avoided, for they get enough of sugar in their ordinary diet, and an excess of it seriously deranges digestion.

It might be said in regard to the subject that I am not now advocating any special climate or other treatment, but simply trying to make the physician appreciate the possibility of cure, if he does all that is possible for his patient by an early diagnosis of the condition, and then uses his best judgment in regard to what is to be done.

I think Dr Robinson's criticism is inapplicable as far as my remarks are concerned; I do not want patients sent away on erroneous diagnoses. On the contrary, what I ask is to have an early correct diagnosis of the condition, and a careful judgment. As to the possibility of an early certain diagnosis of pulmonary tuberculosis, that is usually possible with the aid of the sputum examination, and in rare cases the tuberculin test. As I said before, after the diagnosis is made, the question of sending the patient away or treating him at home, and how to treat him, must be carefully considered and decided in each case on its own merits.

Dr. Robinson, in replying to Dr. Knight, said: My remarks in regard to an erroneous diagnosis did not refer to patients of Dr. Knight. I naturally know that any patient coming from his office would be all right.

THE VALUE OF SYSTEMATIC PHYSICAL TRAINING IN THE PREVENTION AND CURE OF PULMONARY TUBERCULOSIS.

By E. FLETCHER INGALS, M.D.,
CHICAGO.

The absence of systematic study by physicians, and the very meagre literature, compel me in this paper to be more or less dogmatic, yet there are numerous recognized facts that seem to justify calling attention to this subject, notwithstanding the absence of careful clinical observations.

One of the most common observations made by medical men is that the long, narrow, flat-chested individual is the one who is most liable to the development of tuberculosis; and we have all observed that in patients presenting this form of chest the chances for recovery are reduced to a minimum. This single observation is sufficient to suggest that systematic physical training, which would develop the respiratory muscles, expand the thoracic walls, and correspondingly increase the pulmonary capacity, would be of great service, not only in preventing tuberculosis but in curing its early stages.

Pathology teaches us that the collapsed air-cells furnish a most favorable nidus for the development of the tubercular process; therefore, for the prevention of the disease we should adopt measures to expand the lungs and bring the air-cells into the best possible working condition. It is probable that in most cases there is a pretubercular or at least an early tubercular localized anæmia which, by diminishing the nutrition of the parts, lessens their resisting power and makes them

peculiarly susceptible to the malign influence of the tubercle bacilli and the toxins which they produce.

From the widespread prevalence of tuberculosis, which is said to affect 80 per cent. of the human family, it is probable that all of us are at times infected by the Koch bacillus; but so long as the general and local resistance is adequate, it is harmless and the disease can make no progress. This hypothesis is supported by the fact that notwithstanding the large percentage of people affected by tuberculosis, the majority of them recover. Even when the disease attacks the lungs, organs in which the conditions for the spread of the process are peculiarly favorable, it does not prove fatal in more than about 12 per cent., whereas we have good reason to believe that from 35 per cent. to 40 per cent. of the human family are at one time or another affected by pulmonary tuberculosis. In most of those who recover the disease has made but little progress, and it is only at the autopsy, after death from other causes, that its presence is detected. If these views are correct it is clearly our duty to those whose health and lives are placed in our keeping to recommend measures likely to strengthen the resisting power of all the body tissues, but more especially those of the lungs, because they afford the most favorable conditions for the spread of the disease.

Tuberculosis attacking the skin and the bones is so limited by the natural processes that even at its worst it often extends over many years, and in many cases nature throws up an efficient barrier about the infected tissues which prevents extension, and ultimately recovery takes place. Similar processes should be encouraged in the lungs. It is now commonly believed that a high altitude affords the best condition for the prevention of pulmonary tuberculosis and for the cure of its early stages. It is probable that in large part this beneficial influence is due to the increased distention of the air-vesicles, caused by the rarefied atmosphere and by the patient's efforts to more completely fill the lungs. This expansion of the air-cells not only empties them of the noxious principles that if left to themselves would develop into a serious disease, but equal-

izes the pulmonary circulation and removes the localized anæmia which may have occurred as the result either of the deficient functional activity of the part, of pressure, or of partial obstruction of the nutritive vessels. As a means, then, of prophylaxis, our first measure should be to teach the patient to breathe deeply; and as a means of curing the early stages of the disease (which amounts really to little more than prophylaxis for the remaining healthy portion of the lungs) the same methods are most important.

It is a matter of common surprise, to those who have not given the subject thought, to find how superficially some people breathe and how little they know of this most important physiological process. It is common to find persons who get quickly out of breath who would not do so if they only knew how to fill the lungs and when to fill them during exertion. For this reason careful physical training is of the greatest importance, and physicians should see to it that their patrons do not neglect any of the precautions which may give their lungs the best resisting power. One of the first injunctions we should place upon the patient who has any reason to anticipate the development of pulmonary tuberculosis is that he should expand the lungs thoroughly several times every day. We must also personally inspect his mode of breathing, to see that he knows how to carry out our instructions. In order to expand the lungs the patient should be directed to draw in the abdominal walls and take a long, deep breath, while the shoulders are carried gradually backward and the ribs and sternum elevated as far as possible; he should hold his breath for a few seconds and then blow it out slowly and forcibly through a small opening between the lips. In this way not only the air-cells which can be reached by direct inspiration are inflated, but also those at the apices and along the borders of the lungs, which otherwise might not be distended. One has only to try this method of inspiration a few times when out of breath after active exercise, to ascertain how much more effective it is than the ordinary method employed by those who have had no physical training. By a few deep inspirations such as just described, the

healthy individual who has exhausted his breath will find that he can speedily recover it; whereas, by the usual respiratory efforts, he will pant for several minutes before he can obtain relief.

I have referred to the fact that the long, narrow, flat-chested individual is most likely to contract consumption and is least likely to recover from it. The questions arise: First, can systematic physical training cause any considerable change in the form of such a chest? Second, is such training beneficial after disease has actually developed? Without fear of contradiction, the first question may be answered in the affirmative. In the space of a few months such a person may generally be taught to expand the chest two or three inches more than previously, and after the exercise has been kept up for a sufficient length of time the form of the chest will be found very greatly improved and the circumference increased very considerably. This, then, may be considered a most important prophylactic measure.

At Amherst College training is directed merely to securing general good health without attempts at feats of agility or even the development of powerful muscles. The records for twenty years show that in 2106 students who had exercise only half an hour four times a week there was a gain of $1\frac{21}{100}$ inches in chest measurement during their college course. At Bowdoin 200 students with the same amount of work gained an average of $1\frac{75}{100}$ inches in chest measurement in six months. Archibald Maclaren (*Physical Education*) recommends for harmonious development: First, an introductory course of posturing and light exercise with dumb-bells and bar-bells; second, leaping, horizontal beam, vaulting (bar and horse); third, parallel-bars, trapeze, swinging-rings, ladders, horizontal-bar, the plank, escalading; fourth, climbing the pole (fixed, slanting, and turning), the pair of poles, the rope, rosary, and mast. By one hour's daily exercise in this way twelve young men, from nineteen to twenty-eight years of age, gained $2\frac{78}{100}$ inches chest measurement in eight months, and fifteen young men, averaging eighteen years of age, in four and a half months gained $2\frac{48}{100}$

inches chest measurement.[1] Although the increased chest measurement in these cases may have been partly due to natural growth, the rapid and pronounced development leaves no chance for doubting the effects of exercise, and we may safely answer that physical training may in a comparatively short time cause decided improvement even in the long, narrow, flat chest. These facts should also make us more persistent in our efforts to secure proper respiration in all those who are predisposed to pulmonary disease.

Slightly altering the second question, we ask, When tuberculosis has become established in the lungs is it possible to check the process or promote recovery by physical development? This I think we may also answer in the affirmative. We know that the disease progresses from the original point of infection through numerous other foci, each commencing and spreading in much the same manner as the original infection; therefore, the more thoroughly the lungs are aërated the greater resisting power will be acquired by parts still healthy but subject to infection, and the greater chance will nature have to throw up barriers against the disease. Consumption is a disease of such long duration that in the majority of cases there is a period of several months during which, by this means, aided by other measures, we may reasonably expect to check the process, and I may confidently assert that no small part of the credit in favorable cases must be given to pulmonary gymnastics.

It has been asserted that athletes are short lived and that the majority of them die of pulmonary tuberculosis. Whether this assertion can be substantiated or not is an open question; but even if it is founded upon facts, we must take into consideration the further fact that a majority of professional athletes live very irregular lives, excepting for short periods when they are in training for some special event, and it is more than probable that with them early death or carrying off by consumption must be attributed largely to dissipation.

[1] Cheesman: Reference Handbook of the Medical Sciences, vol. ii. p. 759.

The examination of statistics from various colleges has shown that non-professional college athletes in nearly all cases outlive their expectancy as estimated by the most careful life-insurance companies. Although a considerable number of these amateurs ultimately die of pulmonary tuberculosis, the percentage does not appear to be as large as among men who have had no physical training.

My friend, Dr. Otto T. Freer, who has assisted me in the preparation of this article by a very careful search of the journals and books in the Newberry Library, and of such articles as appeared likely to afford any information in the library of the Surgeon-General's Office at Washington, was unable to find anything of value bearing upon this subject, excepting in the monograph of Dr. John Ed. Morgan, entitled "University Oars," which was published in 1873. Out of 255 oarsmen who had rowed in the English University boat races, Morgan obtained replies to his letters from 251 who were alive at the close of the year 1869. Thirty-nine old oarsmen had died; of these, 7 died of consumption and 2 of other forms of chest trouble. Morgan says that, generally speaking, these cases were not of that physical vigor that a long boat race requires. One of these men burst a bloodvessel while rowing, and died some years after of consumption. Another had consumption so many years after his rowing that there could have been no connection between the two. The next case died twelve years after the race. Morgan remarks that he may perhaps have injured himself. Another oarsman died of consumption four years after the race. Morgan's conclusions are that athletics tend to prevent consumption, but that people of delicate constitution should avoid training, as over-exertion may possibly predispose to consumption; his statistics, however, do not appear to justify the latter conclusion.

In the *New York Medical Journal*, July 23, 1898, E. Palier quotes Jageras as stating that consumption is less common among gymnasts than others. Palier himself holds the common opinion that outdoor exercise is a good prophylactic, but does not consider chest development alone sufficient to pre-

vent the disease. He cites frequency of the disease among laborers and soldiers, but gives no statistics. In this connection I may state that consumption is a common disease among those living on farms, although it is usually supposed that they are more exempt than others. The fact of the matter is, that consumption is frequent among all classes, and no one need expect to avoid it by following out any one method of exercise or by any one mode of life.

In *Diseases of Modern Life* Dr. B. W. Richardson inveighs strongly against "training" as done for physical contests, and thinks athletes shorten their lives by it; he says nothing about phthisis, but attributes the evil effects of excessive athletics to heart-strain. He says, "There is no sign, no evidence anywhere that the greater culture of the physical strength has favored the longevity of an individual or the vital tenacity of a race." He thinks that excessive physical exercise insures premature decay and early death, and mentions the Jews as an example of a race of not a high physical standard and of apparent feebleness of body, but he regards it of all civilized races first in vitality. On the contrary, it has been recently stated that the Jews are peculiarly prone to phthisis.

In estimating the good or ill that may result from systematic physical training, it must not be forgotten that the unfavorable statistics have been obtained from a study of professional athletes, or at least from amateurs who have trained excessively. It is a well-established fact that the firm muscles, the rounded chest, and the large respiratory power developed in young men by moderate exercise are seldom lost, even after the exercise has been suspended, but continue for many years or even for life with very little subsequent exercise; therefore, the importance to the young of proper physical culture, particularly of the respiratory muscles, cannot be overestimated.

As to the kind of exercise that is best for this purpose, it is probable that that recommended by Maclaren is as good as could be devised for its general effects. Nearly all forms of exercise that take the person out of doors, such as horseback riding, tennis, ball playing, golf, bicycling, rowing, running,

etc., seem well suited to improvement of the general health, but the methods that have seemed to me most suitable for continuous practice and most beneficial for the development of the chest, are by Indian clubs, the rapid use of small dumb-bells, the horizontal bar, the trapeze, and boxing. In all of these the patient of necessity learns to breathe deeply and acquires strength of the respiratory muscles; but most important for our special purpose is the practice of frequent deep inspiration, whereby the lungs are thoroughly filled, and forcible expiration, which inflates the air-cells at the apices of the lungs. This should be repeated several times daily. In order to secure regularity in this exercise it is generally necessary to recommend for our patients some form of simple inhaler that may be carried in the pocket and used at stated intervals throughout the day. At the same time, according to indications, some stimulant or sedative inhalant may be advantageously employed for its effect upon the mucous membranes of the upper air-passages, but more particularly for its influence in securing regular use of the inhaler; many persons will take some medicine regularly who would soon discontinue systematic inhalations of non-medicated air.

The inhaler that I employ is a simple hard-rubber tube, about four inches in length, and half an inch in diameter, filled throughout its middle two-fourths with corrugated blotting-paper, and having corks for each end, so that it may be closed to carry in the pocket. The medicament is dropped on the blotting-paper and the patient is directed to take long, deep inhalations through the inhaler every two hours during the day. After the instrument is freshly charged the patient inhales but twice, two hours later four times, two hours afterward six, and at the end of the next two hours eight times. The instrument is then to be recharged. The patient is directed to draw in the breath deeply, to hold it for a few seconds, and then expire forcibly with the lips nearly closed. There should be felt a sense of smarting or slight discomfort as low as the fourth rib, lasting from three to five minutes after each inhalation.

The remedies that I employ consist mainly of thymol, men-

thol, tincture of iodine, and formalin in solution in alcohol. Chloroform may be added to any of these to relieve cough. The inhaler is charged with from five to fifteen minims of the solution according to the duration of the sensations which it causes. The strengths commonly employed are: Thymol, 1 to 2 grains to the ounce; menthol, 30 to 60 grains to the ounce; formalin $\frac{1}{2}$ drachm to 1 drachm to the ounce, and tincture of iodine from 2 to 4 drachms to the ounce. Chloroform may be added in any desired proportion. I am satisfied that these inhalations are of signal value in the treatment of laryngitis and tracheitis, because by them the patient may make positive applications to the upper air-passages, which he could not do himself either by sprays or ordinary inhalations. This method of treatment appears to me also of undoubted value in the prevention and cure of pulmonary tuberculosis, though I do not believe that these or any other inhalants have any direct effect upon the tubercle bacilli; but they may mitigate the catarrhal inflammation of the mucous membrane of the upper air-passages that attends the tubercular process. The chief value of this method undoubtedly results from the deep respiration and consequent distention of the air-vesicles and development of the respiratory power which is obtained by its use. Regular, systematic deep breathing cannot be secured with most patients unless some medicament be employed at the time, therefore it is best to use inhalants that cause well-marked sensations and of known antiseptic qualities.

THE PRETUBERCULAR STAGE OF PHTHISIS, OR THE CONDITION WHICH ANTEDATES TUBERCULAR DEVELOPMENT, AND SOME AIDS TO ITS DIAGNOSIS.

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Every one who carefully analyzes the histories of cases of pulmonary tuberculosis must be impressed with the fact that, while the majority apparently start with local manifestations, a large number have exhibited for a longer or shorter time well-marked evidences of an antecedent morbid condition of the general system.

Naturally the first question which arises is, does such an antecedent condition exist with appreciable and unvarying symptoms? There are some who say that it does not exist with symptoms sufficiently constant to be of any positive value; but for myself I feel so assured of its existence that I cannot overestimate the importance of determining and understanding as far as possible fixed signs and more or less reliable and constant manifestations as of supreme importance both to the individual and the State, and it is to the recognition of the pretubercular stage as an important time of warning that I would invite your attention.

For the sake of lucidity in the points which I would emphasize to-day I have assumed that there exists a stage or condition precedent to the initial development of tubercles and to the first appearance of appreciable signs of phthisis. This latter condition is known as the "incipient stage" of phthisis, while, for the sake of clearness, we will call the former condition the pretubercular stage, bearing somewhat the same relation to

phthisis that transient albuminuria does to nephritis. It may be read as an important warning or may be ignored as a morbid condition quite apart from subsequent danger to tuberculosis.

In examining recruits for the army the examination is especially directed to detecting the least evidence of a liability to phthisis, yet statistics show that 7.2 per cent. of those in the French army, who have passed a most rigid examination on this point, subsequently developed phthisis, and in the German, Austrian, and United States armies the percentage is even higher.

The evidences of a vital condition which predisposes to the development of phthisis or actually marks the true pretubercular stage may for convenience be grouped under the following heads:

I. Corpulence:

or the relation of the weight of an individual expressed in pounds, to his height expressed in feet.

II. Chest conditions.

1. Conformation of chest.
2. Chest measurement.
3. Vital capacity.

III. Constitutional condition.

1. Chloro-anæmia.
2. Digestive disturbances.

IV. Character of the pulse.

These heads should be considered in detail, as they are far from having the same value, and their importance is from the relation they bear to one another, and to an abstract standard of normal health.

I. Corpulence. The word corpulence has been introduced by French writers, with the definite meaning of the relations between the weight of an individual and his height, and in the same definite sense I use it now.

Progressive loss of weight, coming on without any apparent cause, such as loss of appetite or other indication of deranged nutrition, is, in my opinion, one of the most constant symptoms of the pretubercular stage; in many cases it precedes for

weeks or months the slight cough with no expectoration, which marks the actual beginning of a pulmonary change suspected but often not recognized. Out of forty cases of phthisis which have come under my observation, and of which very complete records have been kept, 50 per cent. show this antecedent loss of flesh steadily increasing.

While the scales are used very generally in hospitals and sanitariums, it is seldom in private practice that use is made of them for this purpose, which I think is a grave mistake; for not only are they of great service in estimating how much below par is the nutritive condition of a patient, but they are of even greater value in determining how much a patient is improving under a given line of treatment; for it is so seldom as to be almost never that a tubercular patient gains in weight without a corresponding improvement in his pulmonary condition. The actual weight of a person is of no help in estimating his nutritive condition, but the weight relative to the height, or his "corpulence," is of great importance. If this falls below a certain normal standard and remains so without any evident cause, the possibility of tuberculosis developing in those of suitable age is very great, if the disease has not already actually commenced.

The military standard of foreign armies recognizes this important sign, and no conscript is accepted whose corpulence falls below a normal standard. To weed out tuberculosis as far as possible is the object of this rule.

The corpulence of an individual is obtained by dividing his weight by his height, as, for example, take an average man of 5 feet 8 inches, whose weight is 150 pounds (military standard), his corpulence would be expressed thus: Corpulence = weight, 150 pounds : height, 5 feet 8 inches, = 26.47, or 26 as a standard.[1]

While the normal corpulence of men has been settled by military standard, special investigations have been made by Bouchard to determine that of women. After a long series of studies he has found it to be 23; in any case where it goes

[1] Any man whose corpulence falls below 23 should be considered.

below 21 a woman should be considered abnormally thin. In estimating the exact value of corpulence it should be considered in connection with the "vital capacity" (or the thoracic perimeter divided by the height of the individual). The following case will illustrate this.

CASE. *Pretubercular Chloro-anœmia.*—Emma P., housemaid, aged eighteen years. One sister tubercular at thirteen. Patient has always been perfectly well; menstruated at fifteen.

First examination. Anæmic; suffers from dyspepsia; pulse, 99; weight, 104 pounds; height, 5 feet 2 inches; corpulence, 20; thoracic perimeter, 30 inches; pulmonary condition normal.

Second examination (one year later). Weight, 101 pounds; corpulence, 19; thoracic perimeter, 29 inches. Signs of beginning tuberculosis at right apex; arterial pressure, 5 inches of mercury.

II. CHEST CONDITIONS. 1. *Conformation of the Chest.* There is no question that a large proportion of persons have chests which in their conformation differ widely from a normal standard, and this without in any way rendering them especially liable to tuberculosis. Many of these irregularities may be due to faulty positions assumed in childhood, or to the character of occupation in later life, as habitually leaning over a desk, etc. In a word, malformed and flat chests are not necessarily found in consumptives; still there is equally no question that there is a special chest conformation which is found in but very many cases of phthisis, and which, when present in the pretubercular stage, strongly predisposes to the development of the disease. This chest may be described as follows: Narrow in its anterior-posterior diameter, with wide intercostal spaces; the scapula prominent, with depressions of the supra- and infraspinous fossæ; also a subclavicular depression; in other words, a leanness and hollowness to the whole chest. Such a chest, when found in an individual presenting other symptoms suggestive of the pretubercular stage, is an important link in the chain of evidence.

2. *Chest Measurement.* More important than the shape of the chest are the data obtained by measuring the circumference

of the chest; this can be done by use of a graduated tape, or, better, by a double tape (two ordinary tapes joined together), so that the commencement of each tape is in the centre of the double tape, which centre is placed over the spine. The tape should be carried around the chest on a level with the nipples; sometimes, especially in women, it should be carried around lower down, opposite the ensiform cartilage. By having a double tape we can compare not only the mobility of the chest-wall but also the expansion of the two sides. It has been found that the two sides are unequal in their circumference in two-thirds of the persons examined. The right side is one-half inch or more larger than the left; both lungs expand almost equally. The average circular measurement of the chest varies in man within normal limits, but it never should go below thirty-five inches. The average of two measurements, taken at the same point, one at the moment of forced expiration (cough), the other at the end of a forced inspiration (deep sigh), is the "thoracic perimeter." Investigations have shown that the most important point in estimating the value of the chest measurements as a sign of the pretubercular stage is when the relation between the thoracic perimeter and the height is ascertained. This relation constitutes what the French call the "vigor of constitution" of an individual. French military surgeons first ascertained its importance, but its value does not seem to be appreciated in this country. *The thoracic perimeter should never be lower than one-half the height of an individual.*

I have examined a number of cases of early phthisis to ascertain the accuracy of this statement, and have found in a few cases this ratio kept; in most cases it fell below, and in none rose above this standard. It seems, therefore, that the "vigor of constitution" ascertained by the means just indicated may be an important help in diagnosing not only early phthisis but the pretubercular stage; this rule applies equally to women as to men.

3. *Vital Capacity.* Hutchinson, the inventor of the spirometer, demonstrated, by numerous experiments by respiration,

that in a healthy person there is a certain amount of so-called vital respiratory capacity varying according to age, weight, and height. Normal persons should be able to exhale a certain cubic mass of air on a full inspiration succeeding a complete expiration. Vital capacity by itself is, in my opinion, only another very slight help in diagnosis, but when taken in connection with height it becomes an important aid.

The normal vital capacity for a man of 5 feet 8 inches is 230 cubic inches. In a number of patients of about 5 feet 8 inches in height and in the early first stage of phthisis, I found the vital capacity averaged only 160 cubic inches. Personally, I have found that the determination of vital capacity in its relation to height gives more accurate data in determining the pretubercular stage and early phthisis than either corpulence, chest measurement, or chest conformation.

Any valuable use of the spirometer is largely a matter of education; patients have to be taught how to use it or the results obtained will not be reliable. The other disturbances of the respiratory organs besides tuberculosis which modify vital capacity, such as pleurisy, bronchitis, etc., must not be forgotten, and the possibility of their presence in any given case must be thought of. Again, it is well to remember that if a slight increase in vital capacity appears during the treatment of early phthisis, it points toward a favorable prognosis. French investigators have established a boundary line between normal and subnormal vital capacity which we may adopt with advantage.

The relation between height and vital capacity for the normal and healthy man is 1 to 3, for women, 1 to 2.6 ; that is, for each inch of height (man) there should be three cubic inches of vital capacity; when the proportion falls below this we may infer a considerable disturbance in the respiratory capacity; for example, in a man of 5 feet 8 inches this vital capacity should not fall below 204 cubic inches. By way of illustrating the value of the inter-relation of corpulence, thoracic perimeter, and vital capacity in diagnosis, I quote three actual cases given by Dr. Papillon, of the Paris Hospital: Three women

of the same weight, 108 pounds, but whose corpulence and vital capacity differed to a marked degree.

CASE I.—Woman, 5 feet 5 inches; weight, 108 pounds.

(*a*) Corpulence = weight, 108 pounds : height, 5 feet 5 inches, = 20 (below normal).

(*b*) Thoracic perimeter = 31 inches ($1\frac{1}{2}$ inch less than half her height).

(*c*) Vital capacity = 122 cubic inches (47 cubic inches less than normal for a woman of this height; normal 65 inches x 2.6).

Remarks. In spite of this patient's apparently excellent appearance, she was in the early first stage of phthisis; her corpulence and thoracic perimeter were slightly below normal, but her vital capacity was much reduced.

CASE II.—Woman, 5 feet 1 inch; weight, 108 pounds.

(*a*) Corpulence = weight, 108 pounds : height 5 feet 1 inch = 21 +.

(*b*) Thoracic perimeter = 31 inches ($\frac{1}{2}$ inch more than half her height).

(*c*) Vital capacity 198 cubic inches (40 cubic inches above normal; normal 158 +).

Remarks. This woman in weight was apparently below normal, yet her vital capacity and thoracic perimeter were above normal, so we could consider that there was but slight danger from pulmonary complication.

Note. The case proved to be one of simple anæmia.

CASE III.—Woman, 4 feet 10 inches; weight, 108 pounds.

(*a*) Corpulence = weight, 108 pounds : height, 4 feet 10 inches, = 22.

(*b*) Thoracic perimeter, 31 inches (2 inches more than half her height).

(*c*) Vital capacity, 142 cubic inches (8 inches below normal; normal 150 cubic inches).

Remarks. This case was one of cured phthisis who entered the hospital for rheumatism; while her corpulence and thoracic perimeter were up to normal or above, her vital capacity was,

in consideration of her height, so slightly out of ratio as to be virtually normal.

These three cases are interesting as showing how little value weight has as a determining quality unless taken in relation to height and to the thoracic perimeter. The thoracic perimeter, almost identical in these cases, changes its significance completely when considered in relation to height, being less than one-half the height in the early tubercular case, and above the half height in the other two.

III. Constitutional Condition. 1. *Chloro-anœmia.* Many believe that there is an actual antagonism between the two conditions of chlorosis and tuberculosis. (Cornil, Sée, Pidoux.) Haplin, who has investigated this subject, states that in forty cases of true chlorosis in tubercular families which have come under his observation only two became tubercular. Many believe otherwise, and consider certain chloro-anæmics to be well on the road to tuberculosis, and when once tuberculosis has set in the chlorotic state darkens the prognosis. They point out that while the antanæmic treatment by iron benefits pure anæmics, it gives only negative results in cases having a tendency to phthisis.

The writer's personal experience has led him to believe that chloro-anæmia is often one of the most pronounced symptoms of the pretubercular stage of phthisis, especially when taken in connection with loss of weight without cause, and poor chest development. I believe that an unexplained chloro-anæmia in young men should always make us suspicious of tuberculosis. In young girls this symptom is not so important, for from their manner of life and physical condition they are never subject to true anæmia; in fact, I feel one should view chlorotics who grow thin without a cause with grave suspicion. Their corpulence should be ascertained at regular intervals, while rest, fresh air, nutritious food, and appropriate tonics should be at once ordered. In chloro-anæmics, besides loss of weight, thinness of the chest is a bad sign, and suggests liability to the development of tuberculosis. True chlorotics, as we know, show slight, if any, loss of adipose tissue, and the

chest development meets normal requirements. Clinical examinations of the blood have been made, especially in France, during the last few years to ascertain if there be any characteristic change there which marks the pretubercular stage, and also what is the condition of the blood found in the very early stages of phthisis. There is a good deal of variation in the conclusions reached, but all agree that the hæmoglobin is diminished out of all proportion to the loss in the number of red corpuscles. Henocque concludes, after a long series of investigations, that tubercular chloro-anæmia is characterized by one thing, viz.: "the diminution of the oxyhæmoglobin in the blood." Laache says that in his cases he found the red cells diminished on an average of 12 per cent., while the hæmoglobin has reached 29 per cent.

In tubercular chloro-anæmia the hæmoglobin never falls as low as it does in true chlorosis. In the earliest recognizable stages of phthisis there has also been constantly found a slight diminution in the number of red cells and a leucocytosis; the latter is never found in true chlorosis. I think we are warranted in saying that a marked diminution of the hæmoglobin out of all proportion to the slight decrease in the number of red corpuscles is characteristic of a profound chloro-anæmia which often characterizes the pretubercular stage of phthisis; certainly Jaccoud, Malassez, and Henocque believe this to be so. My observation has been limited, and I simply quote their conclusions.

2. *Digestive Disturbances.* We have all noticed how often disorders of the digestive system usher in the earliest stage of phthisis; but have we noted how many of those cases affected with this disease have suffered for months or even years with dyspepsia in some form? What is this relationship between digestive disorders and phthisis? Are these disorders cause or result? Are they symptomatic of the invasion of the tissue by the bacilli, or are they symptomatic of the tissues, undergoing changes lessening their power of resistance to the inroad of the microbes? I believe that digestive disorders precede the deposition of tubercles in the lungs in many cases. Numerous

cases that have come under my observation appear to prove this statement; nine out of forty cases of phthisis, of which I have complete records of antecedent conditions, showed continued digestive disturbances extending over months or even years before the disease was recognized by physical signs. Digestive disorders which cannot be permanently corrected in one at the tubercular period of life are often a symptom of the pretubercular stage of phthisis. The lesson we should learn is not to overlook the possibility of tuberculosis in those cases which superficial inquiry would classify as cases of "indigestion." This "indigestion" is sufficiently often the forerunner of phthisis to put us on our guard.

IV. Character of the Pulse. The character of the pulse in establishing the early diagnosis of phthisis and as one marked symptom of the pretubercular and very early stages of the disease is, in my opinion, important. Only in the last few years has any attention been paid to these indications of the pulse. Since my attention was called to the matter by a paper of Dr. Wells, of Chicago, written in 1895, I have been surprised to note how characteristic and constant is the pulse of this condition, and it has led me to suspect tuberculosis in several cases weeks before the physical signs appeared. It has been claimed that the reason this pulse has been overlooked by clinicians is that it is found only at the very beginning of phthisis and in the pretubercular stage, and disappears early in the disease. This pulse has two characteristics:

1. *Change in Position of the Patient has but Little Influence on its Rhythm.* To ascertain whether this is so in a given case the patient must be examined several hours after eating and when free from excitement. Ordinarily the pulse varies about fifteen beats in a healthy man on change of position.

2. *Relative Feebleness of Arterial Pressure.* This characteristic of the pulse, suggested by Dr. Wells and confirmed by the French investigators, is believed by them to be an important element in diagnosis. They found that instead of the arterial pressure being 15 to 18 centimetres of mercury, as in

the healthy man, it was always less than 13 centimetres, sometimes even as low as 10 centimetres. In pulmonary tuberculosis they also found that in those few cases of normal or excessive arterial pressure there was some other condition associated with the tuberculosis, such as nephritis, to account for the increase. If this were true only in the advanced stages of tuberculosis it would not be of any diagnostic value; but it was also found in the pretubercular and very early stage—in one case where physical signs did not appear for nearly two years later. This lessening of arterial pressure must certainly put the organism in a state of microbic receptivity. We should be especially anxious in cases of anæmia with feeble arterial pressure. The pulse of this lowered arterial pressure yields a peculiar sensation somewhat suggesting the "Corrigan" pulse, being tense and hurried, seldom beating less than 100 per minute, often 110 to 120. In the early stage of phthisis we also note a non-concordance which often occurs between the acceleration of the pulse and the rise of temperature. I have personally confirmed these characteristics of the pulse as just described, and I bring them before you as well worthy of further study.

Dr. Anvord has just published a very interesting article on "Latent Tuberculosis and the Pulse of the Tubercular," in which he claims that the pulse-tracings of this condition are characteristic, viz., there is a suddenness of the ascent and descent of the curve. He also noted that as a person recovered from phthisis the pulse-curve came down more nearly to normal. He was unable to find any characteristic tracings in the pretubercular stage.

Summary.

1. It is possible in many cases, especially in chloro-anæmics, to diagnose phthisis previous to the appearance of physical signs or of the tubercle bacilli in the sputum.

2. Weight, respiratory capacity, and chest measurement have no value in establishing the possibilities of the develop-

ment of phthisis in themselves, but must be considered in relation to the height of the person, when they furnish three important aids to diagnosis.

3. Corpulence is obtained by dividing the weight expressed in pounds by the height expressed in feet (in a normal man it should be 26, in a woman 23).

4. Thoracic perimeter is found by taking two measurements of the circumference of the chest, one at the moment of forced expiration, the other at the end of a forced inspiration. The average of these two measurements should never be less than half the height.

5. Vital capacity is the amount of air, expressed in cubic inches, which can be exhaled after a full inspiration. Normally it should bear the relation to the height of 3 to 1 for a man, and 2.6 to 1 for a woman—*i. e.*, for every inch of height there should be 3 (or 2.6) cubic inches of vital capacity.

6. Chloro-anæmia and persistent and unexplained disturbances of the digestive system are symptoms of the pretubercular stage of phthisis.

7. There are two characteristics of the pulse found in the pretubercular and early stage of phthisis:

(*a*) Change of position has practically no influence on its rhythm.

(*b*) Relative feebleness of arterial pressure.

NOTE UPON THE POSITION OF THE LOWER BORDER OF THE HEART:

With a Reference to the Topographical Anatomy of the Organ.

By GLENTWORTH R. BUTLER, M.D.,
BROOKLYN.

These brief notes relate to the topographical anatomy of the heart. Two points are to be considered: first, the position of the lower border of the heart; second, the relation of the anterior surface of the heart to the chest-wall.

1. The lower border of the heart is usually stated to lie above the junction of the sternum and xiphoid appendix on a level with the sixth chondro-sternal articulation. There is good reason to believe that, while this statement is true for the cadaver, the lower border lies during life, in 70 per cent. of well-formed normal chests, at a lower point, this point being at least one-half an inch below the sterno-xiphoid junction. This statement is based primarily, in point of time, upon the work done by Sibson two decades ago. His opinion with reference to the position of the lower border of the heart during life is founded upon three considerations derived from careful measurements in seventy-one bodies.

First, that at the time of death the heart is raised toward its higher points of attachment by the elevation of the diaphragm at the moment of the final expiration, so that an average space of half an inch is left between the lower border of the heart and the lower boundary of the front of the pericardium. This space is an exact measure of the post-mortem upward shrinking of the heart.

Second, it was found that there is a general correspondence between the relation of the lower border of the right ventricle to the end of the bony sternum, and also between the relation of the lower border of the apex to the lower edge of the fifth rib and cartilage. The lower edge of this rib was, in sixty out of seventy-one cases, an average distance of half an inch below the sterno-xiphoid junction. As the average dip of the lower border of the heart from right to left is also half an inch, it is obvious that, except in a few instances, the apex-beat could not be felt in the fifth interspace if the lower border of the heart lay above the end of the osseous sternum.

In the third place, the lower border of the right lung anteriorly at the point where it overlaps the lower right border of the heart is, in the majority of cases, on a level with the latter. The position of this portion of the border of the lung may, therefore, be taken as an index of the position of the lower border of the heart. It was found that in twenty out of twenty-nine cases the lower edge of that portion of the lung lay, on an average, one-half an inch below the junction of the sternum and ensiform appendix.

The conclusions reached by Sibson are curiously confirmed by a comparison with fluoroscopic diagrams of the normal heart-relations very kindly furnished in a personal communication by Dr. F. H. Williams, of Boston.

The arguments of Sibson and the revelations of the x-ray combine to place the lower border of the heart in a normal chest at a lower point than is generally stated—this point lying in most cases half an inch below the sterno-xiphoid articulation, about at the junction of the upper and middle thirds of the appendix. The clinical value of this fact is perhaps not very great, because of the acknowledged difficulty in determining the line of demarcation between heart- and liver-dulness.

2. The second note is concerned with the relation of the parts of the anterior surface of the heart to the chest-wall.

The best recent description of the surface anatomy of the heart is that of Keiller, based upon the models of His and his own gelatin-injected specimens. Keiller's description does not

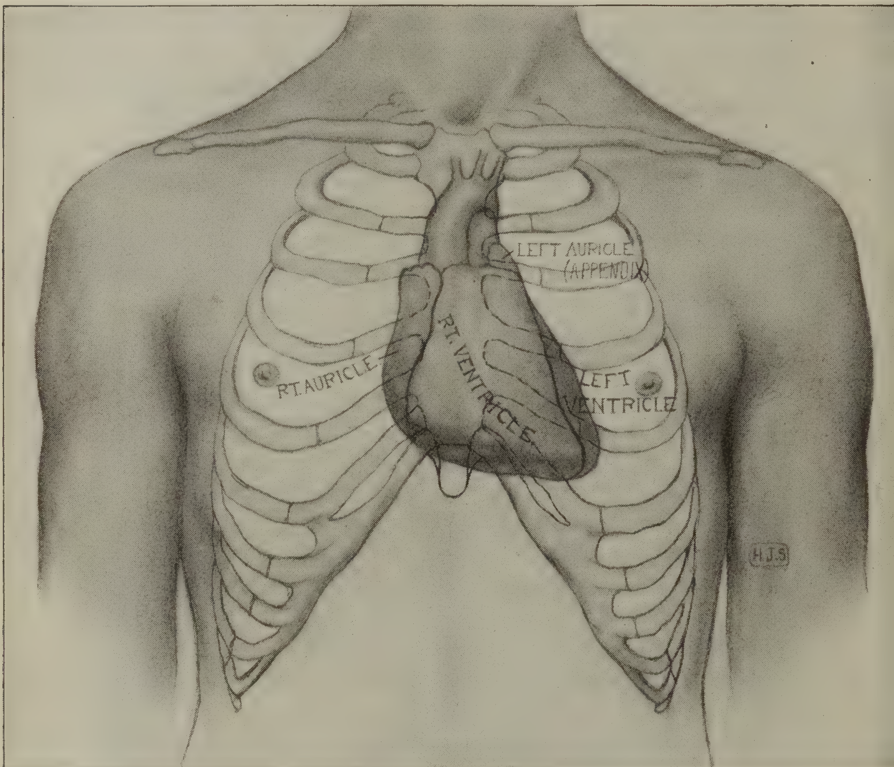
correspond with that usually given of the flattened empty heart as it lies upon the autopsy table, but its truthfulness appeals at once to the reader as affording a vastly more vivid conception of the form of the blood-distended living heart. The present purpose will be fully subserved by describing the heart as a whole and the anterior surface in particular.

Instead of stating that the heart is conical or pear-shaped, with its base upward and to the right, it is in keeping with the facts to describe it as an irregular four-sided pyramid. The base of the pyramid rests upon the diaphragm. Its apex is truncated, thus offering a place for the roots of the upspringing great vessels. It therefore possesses five surfaces—anterior, posterior, right, left, and inferior (the base)—with well-defined borders separating them.

The anterior surface, which is more particularly under discussion, is triangular in shape, slightly curved, and lies parallel with the posterior surface of the sternum. It includes from right to left the whole appendix and a part of the right auricle, the greater part of the right ventricle, and portions of the left appendix and left ventricle. It is separated from the right surface by the convex and nearly vertical right anterior border; from the inferior surface, or true anatomical base, by the sharp, almost straight antero-inferior border; from the left surface by the convex, slightly rounded oblique left anterior border. The upper angle of the anterior surface is the anatomical apex, and merges into the anterior walls of the great arteries. The left anterior angle is the clinical apex.

The accompanying diagram is drawn in accordance with the facts just rehearsed, except that the right lower angle of the heart is rounded in correspondence with the findings of the fluoroscope. Owing to the normal anatomical and functional variations in the shape of the heart, and the considerable changes in its position resulting from respiratory action, bodily position, and the shape of the thorax, no one diagram can tell the whole story. This diagram is believed to afford a reasonably accurate representation of the anatomical projection-outlines of the normal heart in a well-formed thorax during quiet

respiration. In view of the desirability of correctness in illustration a comparison with certain published drawings is sufficient and comment unnecessary.



DISCUSSION.

Dr. Didama: Would not the aspirating needle be liable to puncture the heart in operation for pericardial effusion if it is so much lower than it is supposed to be?

Dr. Musser asked Dr. Butler whether he had been able to demonstrate Ebstein's triangle, and suggested that the x-rays would give most valuable information on the topography of the heart.

Dr. Coleman asked if the position of the heart changes when the position of the body changes.

Dr. Butler, in closing, stated that before becoming acquainted with the models of His and the description of Keiller he had not realized that the living heart was so much flattened laterally as well as antero-posteriorly and that its four surfaces and base were so distinctly modelled.

The demonstration of the resonance of Ebstein's triangle is undoubtedly of great clinical value, and its disappearance is good proof of pericardial effusion. It is, however, a moot question as to whether any method of percussion will enable the full extent of the right border of the heart to be mapped out, as in a normal heart the cardiac dulness rarely extends to the right of the sternum, whereas we know from incontrovertible anatomical data that the right auricle passes one inch to the right of the sternal edge. An inspection of one of Braune's frozen sections will show that there is a greater thickness of lung between the right border of the heart and the chest-wall than lies in front of the left border (one to one and a half inches), which may account for the greater uncertainty in delineating the dexter border. Auscultatory percussion is, perhaps, rather more serviceable than any other. Ordinary percussion is a total failure in outlining the heart. Sansom's pleximetric method is very reliable.

Dr. Butler further said, with reference to Dr. Williams' criticism, that he was obliged to make a conjecture as to the position of the diaphragm during quiet respiration, as the diagram did not show it; but as the upper and lower limits of the excursion of the lower border of the heart both lay below the lower end of the sternum, his mistaken conjecture did not affect the statement as to the position of the lower cardiac border.

A CASE OF DISSECTING ANEURISM OF THE THORACIC AORTA RUPTURING INTO THE PERICARDIAL SAC AND CAUSING DEATH.

By JUDSON DALAND, M.D.,
PHILADELPHIA.

The rarity and completeness of this lesion, the evidences of complete reparation of a similar lesion below the former one, the extraordinary changes in the heart and aortic valves, together with the unusual mode of death, led me to call your attention to this case.

The patient from whom this specimen was removed consulted me in November, 1882, at which time he was thirty-eight years of age. He was a merchant by occupation, married, and had three healthy children. His personal and family history contained nothing of importance excepting that he confessed to the moderate use of whiskey. He denied syphilis and rheumatism. He sought relief from œdema of the legs, headache, and diarrhœa. Examination of the lungs gave negative results. The heart showed slight evidences of left ventricular hypertrophy, with accentuation of the aortic second sound. The radial artery was wiry and the pulse-rate was normal. He passed thirty-two ounces of urine in twenty-four hours, which contained about 2 per cent. of albumin, no sugar, acid reaction, specific gravity 1010, and the sediment contained a few narrow hyaline tube-casts. Under absolute rest, eight ounces of buttermilk every two hours, and Basham's mixture, his urine increased in quantity, the albuminuria diminished, only an occasional tube-cast could be found, and in one month the dropsy disappeared. The headaches were reduced in severity and occurred for a short time upon alternate days. The diarrhœa was replaced

by constipation, and he was given fluid extract of jaborandi in twenty-drop doses thrice daily. He gradually resumed a mixed diet, and felt so well that he did not consult me for four years.

During this interval he returned to the habit of drinking whiskey, the quantity of which he gradually increased until he was averaging two pints daily, although frequently this quantity would be increased to a half gallon. Examination showed marked arterio-capillary fibrosis, a considerable increase in the amount of hypertrophy of the left heart, accompanied by a faint systolic murmur, best heard at the apex and transmitted into the axilla. He reported that two years previously he suddenly experienced complete loss of muscular power without other symptoms. His urine presented a moderate amount of albumin and a few hyaline tube-casts.

Three months later he complained of excessive muscular weakness and fear of death, accompanied by headache and morning vomiting. The urine contained 1 per cent. albumin, no sugar, acid reaction, specific gravity 1010, and the sediment contained a moderate amount of blood and a few hyaline and blood-casts. In a few weeks he suddenly developed left hydrothorax, with excessive frequency and irregularity of breathing, rapid and irregular heart action, and cyanosis, which was relieved by thoracentesis. He improved slowly, although still very feeble. The mitral regurgitant murmur became harsh and very loud. Aortic second sound was loud, accentuated, and ringing in character, but unaccompanied by a murmur. The apex-beat had descended to the seventh interspace, and was displaced to the third anterior axillary line. The heart's action was irregular, frequently intermittent, and numerous abortive systoles occurred.

In 1887, or five years after he first came under observation, the ordinary evidences of cardiac failure showed themselves. In December of the same year he died suddenly, apparently from cardiac failure. The diagnosis was marked arterio-capillary fibrosis, enormous left ventricular hypertrophy and dilatation with mitral regurgitation, and chronic interstitial nephritis alcoholica.

The autopsy was performed at his home, twenty-four hours after death, under great difficulties. The brain and cord could not be examined. The kidneys showed the ordinary evidences of chronic interstitial nephritis. The remaining organs, with the exception of the heart and aorta, presented nothing of importance. Upon opening the thorax the central portion of this cavity was chiefly occupied by what at first glance appeared to be the heart. Upon opening the pericardium it was found to contain more than a pint of blood. There were a few slender pericardial adhesions and a considerable quantity of fat, more particularly over the upper portion of the right ventricle and the auricle. The heart and a portion of the aorta were freed from blood, and, after having been in alcohol, weighed two pounds. At the time of the autopsy it must have weighed considerably more. The left ventricular cavity was larger than the closed fist of an adult. The left ventricular wall in the neighborhood of the interventricular septum varied in thickness from half to one inch. Other portions of the ventricular wall measured from half to three-fourths of an inch. The trabeculæ were numerous and unusually large and thick. The papillary muscles were extraordinarily hypertrophied, one measuring one and three-fourth inches in length and three-fifths of an inch in width. A second measured one and one-half inches in length, one-half inch in width, about as thick, and was somewhat rounded in shape. The interventricular septum measured three-fourths of an inch in thickness. The muscular fibre was firm in consistency and of good color. The left ventricular cavity was greatly dilated and was about the size of an ordinary orange. The walls were considerably hypertrophied. The foramen ovale was closed. The right ventricular cavity was relatively very small and had been encroached upon by the enlarged and hypertrophied left ventricle. The walls were moderately hypertrophied, as were the trabeculæ and the papillary muscles. The tricuspid orifice was enormously dilated. The valves were normal excepting for the thinning of their edges, and the chordæ tendineæ showed attenuation and elongation. The pulmonary valves looked larger than normal,

although otherwise unchanged. The right auricle was moderately dilated and the pectinate muscles were slightly hypertrophied. The mitral valves were competent. The anterior leaflet appeared small, measured one inch in length, and at its free edge was unusually thin and knife-like. The posterior leaflet presented a similar appearance, excepting for a pedunculated growth upon its anterior surface one-fourth of an inch from its free edge, which apparently was a small fibroma. The chordæ tendineæ were elongated; many of them were extremely attenuated, some no thicker than a hair, and two of them had ruptured. The aortic leaflets were thickened; the corporæ aurantii were enlarged and two of the cusps showed fenestrations. The middle cusp measured one and one-fifth inches in width by four-fifths of an inch in depth; the left and right cusps measured one and one-fifth inches in width and three-fifths of an inch in depth. The original measurements were greater than this, as considerable shrinkage had taken place as the result of the long-continued action of alcohol, in which the heart had been preserved for eleven years. The aortic orifice seemed enlarged and measured three and one-half inches in circumference. The coronary orifices were enlarged and the artery pervious. One-quarter of an inch above the free edge of the aortic valves there are evidences of complete rupture through the intima and a portion of the media, involving the entire circumference of the artery. The rupture was irregular, immediately above the middle cusp, and the separation between the broken coats of the artery varied from three-fifths of an inch to one-fourth of an inch. At the widest portion, immediately above the right aortic valve, there was a localized bulging, the blood being separated from the exterior chiefly by the adventitia. This rupture was probably coincident with the attack of unconsciousness which occurred three years before death. The edges of the rupture had been agglutinated by adhesive inflammation, and complete healing had been effected.

Immediately above this old healed rupture, at a distance of one-half inch, a recent break had taken place through the intima and a portion of the media, including the entire cir-

cumference of the vessel. At the autopsy it looked as though one had taken a knife and cut through these tissues. The blood had dissected between the coats of the aorta, almost making one tube within another. The space between contained a large number of clots, some of which were firmly and tightly adherent. One-half inch above this recent rupture of the aorta a linear spot was discovered, measuring one-half inch in length, and parallel to the long diameter of the artery. It communicated directly with the pericardial sac, and was the immediate cause of death. There is evidence that the dissecting aneurism extended for an unknown distance into the thoracic aorta.

DISCUSSION.

Dr. Robinson inquired whether members had observed any cases in which the arterio-capillary fibrosis might be traceable to continued nervous strain as a special cause.

Dr. Jacobi: I can simply say that it has often appeared to me as if sometimes the relation of cause and effect was just the reverse. Many times I had the impression that a nervousness that was generally accused of having been the cause of fibrosis was rather the result of circulation impeded by fibrosis, so that neurosis was not the cause of fibrosis, but irregular circulation, as depending on fibrosis, was the cause of neurosis. But this may be a class of exceptional cases only.

Dr. Quimby: A condition that has interested me for a number of years is that of fibrosis, or rather, the processes that are precedent to fibrosis. I have been accustomed to regard nervous conditions as one cause of fibrosis.

Dr. Curtin read a paper a few years ago on "Congenital Mitral Stenosis and Its Effect on the Development of the Entire Vascular System." I see, not so infrequently, cases where the general nutrition is low, with a tendency to defective action throughout the system, sluggish action of the liver and spasmodic action of the nervous system, which I have attributed to congenital defective development. Such patients require abnormal nervous stimulus and even greater hyperactivity of the heart and arteries to maintain even moderate nutrition. We find that with them very slight efforts start up a peculiar change, shown by increased tension of the vessels and proportionately excessive increase of the heart's action, which, with the

cessation of effort, is followed by absolute exhaustion, with the nervous system all gone to pieces. These patients usually feel best in the latter part of the day and up to midnight; but to get out of bed in the morning is the horror of their lives, and they feel more exhausted after a night's sleep than on retiring after a day of activity. These are the cases often classed as neurasthenics. But most of them are strong nervously, and become exhausted only through excessive demands on the nerves to keep up the function of inherently weak organs. To keep up such functional activity there must be high arterial tension, which eventually results in arterial degeneration and subsequent fibrosis. More unfortunate is the class of mind workers, who have apoplexy because they do not get fibrosis, because their nutrition is too low even to produce fibrosis; so that with the degeneration in the arterial wall there comes weakening without fibroid repair and protection, and hence rupture.

Dr. Daland: It seems that unquestionably there is a class of cases, as described by Dr. Jacobi, where the nervous symptoms are secondary to arterio-sclerosis. There are a very large number of cases where the conditions as described by Dr. Quimby exist. In speaking of the influence of the nervous system as an etiological factor I had in mind cases where the kind of mental work might be compared with great justice to the amount of physical work performed by the blacksmith, simply for comparison's sake. These individuals perform great mental exertion and keep it up continuously, oftentimes losing much sleep. A number of them develop a fibrosis as the result of this particular condition, and it might, therefore, be ascribed in a large measure to the direct influence of the nervous system. It would seem that additional causes than those already mentioned by the author must be brought into play to explain many cases.

THE INFLUENCE OF RESPIRATION UPON THE HEART'S ACTION.

With Sphygmographic Tracings of a Case of Voluntary Cardiac Inhibition.

By ROLAND G. CURTIN, M.D ,
PHILADELPHIA.

The reports which accompany this paper open up the subject of the relation between the action of the circulatory and respiratory organs. The observations which I wish to report to the Association are as follows:

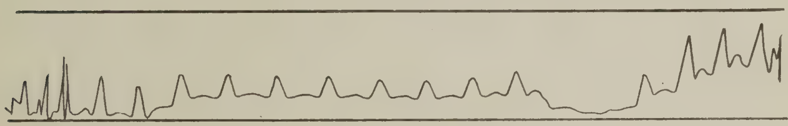
Through the kindness of Dr. Thomas J. Yarrow, Jr., of Philadelphia, I am able to present to you the report of a healthy man, a physician, who could, at will, modify his circulation, and even arrest it. The accompanying tracings of his radial pulse were taken by Dr. Yarrow.

In my observations of this man, while showing his ability to change and even arrest the action of his heart, I noticed that he first modified his respiration. When he desired to stop his heart he would take a full inspiration, hold it, and strain like a woman bearing down in labor; his diaphragm was fixed and his face red and turgid. This seemed to be a necessary procedure, preliminary to the modification or arrest of his heart's action. This man was twenty-six years old, rather short, heavy set, with light hair, and of a neurotic temperament.

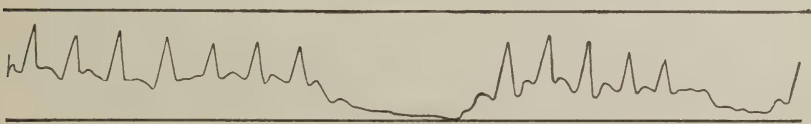
You will notice that in Tracing I. the inspiration was forced and held at first, and the will was exerted, the heart was arrested during the period of three beats; and in Tracing II., with like conditions, almost four beats were omitted. In Tracing

III. two beats were almost lost, and, following them, six beats were entirely absent. Respiration had entirely ceased during that time, and the power of the will was exerted when the

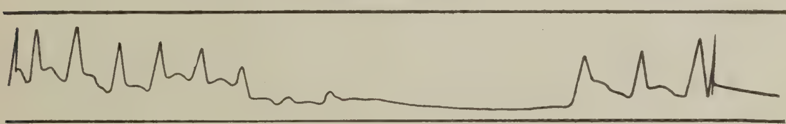
Tracing I.



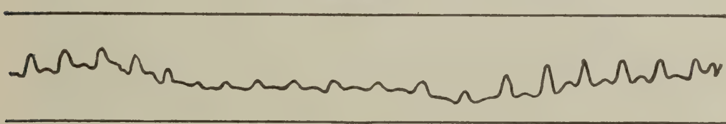
Tracing II.



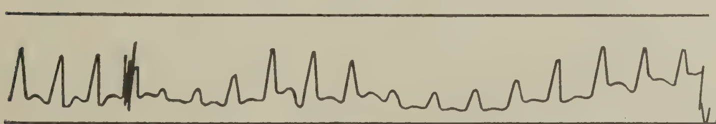
Tracing III.



Tracing IV.



Tracing V.

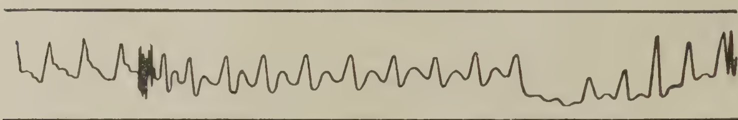


pulse ceased beating, In Tracing IV. the breath was held, and the fifth beat, you will notice, was modified. Respiration was again resumed at the fourteenth beat; the will, in this

instance, not having been exerted over the heart. Tracing V. shows an irregular pulse caused by irregular deep breathing.

In Tracing VI., forced, held inspiration, with straining of the abdominal muscles, was commenced after the third beat, and continued. Where the interim occurs an effort of the will was made to arrest the heart's action. You will observe that

TRACING VI.



the holding of the breath modified the heart's action somewhat, an effort of the will being made where the tracing near the end shows the sudden drop.

Tracing IV. illustrates the influence of simply holding the breath.

In Tracing V. irregular breathing caused an irregular tracing.

In every case, both the will-power and held inspiration were necessary to cause an omission of the beats.

I will call your attention to the fact that the person on whom these experiments were made was a physician, and had he not had his attention called to the subject in his studies, he probably would never have known of his ability in this direction. Perhaps many persons have the power to stop their hearts at will, but a want of the requisite knowledge or a fear of meddling with such an important organ deters them from finding out whether or not they are able to arrest its action.

I recently saw, in consultation with Dr. A. H. P. Leuf, a child who had a serious double mitral disease of long standing, which was associated with marked neurasthenia with heart-failure, developed by an attack of recent influenza. While auscultating her chest I asked her to hold her breath, so that I could better hear the sounds of her heart. After the suspension of respiration during the time necessary for three

breaths, I found that the heart began to slow up and to beat less strongly. This was repeated three times, with a like result each time.

Another case was a patient with uræmic coma and Cheyne-Stokes respiration. The change in the rhythm of respiration had a marked effect on the action and strength of the heart, the sounds being lessened in force during the period of slowed respiration, so that only the second sound of the heart could be heard.

The influence of respiration on the heart may sometimes be observed while holding the finger on the pulse of a person who is dying. The pulse is lost after respiration ceases ; soon after respiration is re-established, and following it, the pulse is restored. This may occur several times before the patient dies. The same is true in uræmic coma, in opium-poisoning, and in other conditions.

In marked tricuspid regurgitation, when the jugulars are pulsating, we see them rise and fall with each respiration. At the end of expiration they are full, and when the patient inspires they collapse, to fill again during the next expiration.

In apoplexy and opium-poisoning we have a slowed respiration and a slowed pulse. If, in any disease, the relation between the two (four to one) is markedly changed, we generally look for some local cause.

In looking over the literature which bears upon the subject under consideration, the following extracts are interesting in this connection :

"An Englishman, Colonel Townsend, asserted that he could arrest the movements of his heart for half an hour. Cheyne relates that this colonel, who had been sick for a long time, took it into his head one day to send for Drs. Cheyne and Baynard, who were in attendance upon him, and for Mr. Skrine, his apothecary, to beg them to witness a singular experiment which he was anxious to repeat in their presence ; it was to cause himself to die and to return to life. The patient lay on his back ; Dr. Cheyne kept his finger on his pulse, Dr. Baynard placed his hand over the heart, and Mr. Skrine held

a mirror before the mouth. Shortly after, no arterial pulsation or cardiac movement could be felt, and the breath did not dim the glass." It will be noticed that his breath ceased, but it is not stated whether it was preliminary to or part of the general result. (Wardrop's *Diseases of the Heart.*)

Wardrop (*Diseases of the Heart*, p. 85) gives the result of the interesting experiment of Sir Benjamin Brodie. It has been shown that "when an animal is decapitated or the brain is under the influence of poison, and the heart has even ceased to beat, its action may be restored by artificial breathing."

Müller's experiment shows the effect of respiration alone on the pulse: "Close the mouth and nostrils and then make a forced, prolonged inspiratory effort. Before doing so feel the pulse and keep feeling it. Note, now, the cessation of the pulse-beat. The intrathoracic vessels are filled with blood, and the distended auricles are unable to contract."

Here, in this experiment, the pulse was seemingly arrested without any exercise of the will.

Valsalva's experiment: "Make the experiment as before, but make a prolonged vigorous expiration. Note fall in pulse-beats." (*Practical Physiology*, Sterling, Philadelphia, 1895, p. 295.)

It is a question as to whether Valsalva means to indicate a fall in the strength or a diminution in the number of beats, or both.

Donders and M. Chauveau, who state "that after preparing himself by taking a deep inspiration which caused 4850 to 5800 cubic inches of air to enter his chest, to stop his heart for a whole minute. It was not merely by auscultation that this could be proved; the sphygmograph applied to the radial artery gave a perfectly straight line, corresponding to this space of time. Some persons, therefore, can arrest their circulation for an instant."

It may be well to consider the effect of held respiration upon the circulatory and pulmonary organs.

When respiration ceases, the blood circulates slowly in the lungs for want of proper aëration. The right heart becomes engorged, and the blood is backed into the cavæ, and, finally,

to the capillaries. At that point the flow from the arteries is arrested. The cavities of the left heart not being filled, the natural stimulus to contraction is absent, and so the heart is retarded in its action. If, to the arrested respiration, a forced expiration is added, the rigid and elevated diaphragm, as well as the compressed chest-walls, may further assist in oppressing the heart and retard its action. During inspiration the lungs expand, which increases their capacity for holding blood as well as air, and the blood flows rapidly from the right side of the heart into the expanded lungs, filling them.

In expiration the reverse occurs, the lungs collapse, and the blood is squeezed out, and flows in the direction of the left side of the heart.

You will observe that we have, then, a number of conditions which favor an arrest of the heart.

Wardrop (*Diseases of the Heart*) says, "Inspiration may be, therefore, considered as accessory to the *venous* blood and expiration to the arterial circulation; the one aiding the heart like a suction, and the other like a forcing pump."

In the study of the subject of voluntary arrest of the heart, it would seem that the simple stopping of inspiration is not, usually, sufficient to accomplish it; but that another strong element is necessary; for, while but few people can voluntarily stop the heart, everybody has the ability to stop breathing. Fixation of the muscles of respiration and the arrest of breathing are certainly helps in producing this condition.

Now, what is the stronger element?

1. The will is stronger in some persons than in others; but this factor was absent in some of the cases mentioned in this paper, for they were unconscious.

2. The nerve-supply *may* be unusual—*i. e.*, an augmentation of that of the cerebro-spinal system, bringing the heart under control of the will, so as to permit the individual so constituted to control the action of the heart.

Obviously, it is well that we do not generally have such control of our hearts; and if we have, it is better for us not to have a knowledge of it.

Conclusions. 1. In nearly all cases of voluntary arrest of the heart, the aid of suppressed respiration must be called in.

2. The will alone will not cause the heart's arrest, except, perhaps, in some very rare cases.

3. In disease and health we have shown that the pulse is modified by respiration.

The subject I have discussed in this paper is, I think, of practical value in the treatment of some forms of pulmonary and cardiac diseases, and I think that the study of the relation between these organs may often assist us in relieving patients of some of the more distressing symptoms. In cases of sudden and extreme heart-failure, why should we not resort to artificial respiration to keep the heart acting until the danger is over?

In opium-poisoning, when respiration has about ceased, the heart may be assisted by artificial respiration the same as is used in resuscitating drowning cases.

Dr. Williams has just shown us in his x-ray photographs that in held inspiration the heart fails to expand to the extent that it does in ordinary respiration. He has also shown that the heart expands less where the lung is impeded by any disease. His demonstrations seem to prove the position I have taken in my paper, that the force of the heart is influenced by the action and inaction of the lungs.

Since reading the above paper I have found in the *International Medical Magazine*, of October, 1898, the *résumé* of a paper by Dr. Reineboth, of Halle, on the "Pulsus Paradoxus." He says: "By 'pulsus paradoxus' is meant that the pulse becomes smaller during inspiration. It occurs in sound persons, but especially in heart weakness, particularly in moribund cases of pneumonia." I have added this quotation as it refers to the question discussed in my paper.

DISCUSSION.

Dr. A. Jacobi: The last remarks of Dr. Curtin remind one of the results which every one of us has probably had in opium-poisoning. Opium-poisoning, with loss of arterial pulse, may have lasted quite a long time, and artificial respiration will often restore it. The cases reported by O'Dwyer in the last few years, and those of such of us as have used his apparatus for artificial respiration, are certainly proofs of that fact. Before we had that apparatus we used all other means of artificial respiration with more or less fair results. In considering the whole question I think the medulla oblongata should be taken into consideration, for we find there the respiratory and the circulatory centres very near together, and the same condition of the medulla will probably control both. We know that the absence of oxygen or the presence of an undue amount of carbonic acid in the medulla affects both circulation and respiration. We know that respiratory spasms, such as whooping-cough, come mostly in the night. I believe part of the cause of those attacks coming in the night is not so much the falling down of the mucus into the larynx or the accumulation of cocci, but the accumulation of carbonic-acid gas in the medulla during the time of sleep, when respiration is impeded or slower than during the waking hours. I have, in cases of asphyxia, very frequently resorted to the following procedure, which I have described before, viz.: When the child is so asphyxiated or atelectatic, I have suddenly increased the amount of carbonic acid in the medulla by closing the baby's mouth and nose for a few seconds; the result is invariably, I believe from the irritation caused by the sudden accumulation of carbonic acid in the medulla, deep inspiration. Part of the drift of the paper is certainly confirmed by such observations.

Dr. Beverley Robinson: I would ask Dr. Curtin if he has noted any possible applicability of the control of the heart's action to the distressing attacks of tachycardia.

Dr. Judson Daland: I am extremely interested in Dr. Curtin's paper. I have had no experience regarding the control of the heart's action by the will. The point that impresses me most strongly is the one that has been before us, namely, the decided effect we may secure over the heart's action by systematic regulation of respiration. We can, therefore, utilize the respiratory movements for their effect on the heart and circulation.

CLINICAL NOTES ON ASTHMA AND ITS TREATMENT.

By BEVERLEY ROBINSON, M.D.,
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Among the diseases the practitioner is called upon frequently to treat, none is of greater interest than asthma. Possibly this interest is due in part to the fact that its immediate causation is at times very obscure. No doubt, however, it is accentuated much by the fact that when we are sure as to the cause of the asthmatic attack, or condition, we can in many instances be of great service to the sufferer. This statement is, of course, more correct where we encounter cases which are relatively of late date, and where, if the etiology be determined, we can be confident as to our power to relieve or cure.

The cases of so-called nervous asthma, or asthma merely functional and without fixed causation, have been in my experience relatively very infrequent. I do not doubt that they do occur, because many reliable authorities speak of them in no uncertain terms. And yet I do believe, when we are better informed, such examples of purely functional asthma will dwindle immensely, and perhaps, indeed, no longer be described. I do not wish to be misunderstood. In the majority, not to say all cases of asthma, there is probably a certain sensitiveness of the central or peripheral nervous system which accounts in a measure for the recurrent attacks of this affection. What I wish to insist upon, however, or emphasize most emphatically, is that despite the existing nervous irritability, the asthmatic attack would rarely occur were there not some other discoverable cause which more advanced researches will reveal to us.

Conditions of the blood are often ignored which, if closely inquired into, will throw light upon an otherwise very indefinite causation. Malarial toxæmia is frequently present and yet ignored. The reason for this is because, first, malaria may be present, causing slight enlargement of spleen and liver, moderate secondary anæmia, engorgement of the nasal, laryngeal, tracheal mucous membrane, or other parts of the upper or lower air-tract, and yet be lost sight of, or its presence questioned or doubted. Again, this is true where there is apparently no physical change of organ; and yet constant or frequently recurring symptoms of headache, backache, disordered stomach, general fatigue, inertia, irregular chilly sensations, inappetence, constipation, or diarrhœa, may be proof of or point toward it. It is wisdom for an observing practitioner to be quick to see and act in accord with its recognition. If a blood examination be made under one or other of these circumstances, shall we be definitely informed as to the malarial nature of the condition preceding the asthmatic seizure? Occasionally, yes; more frequently, not to say usually, no, in such instances. If there has been a sudden chill, followed by rise of temperature and sweating, and if at the time of the chill and previous to the giving of quinine internally, a skilful microscopic examination of the blood be made, the plasmodium malariæ should be found, usually but not invariably. When we are face to face with the asthmatic attack how should we proceed, given a possible or probable malarial causation? If it be only indefinite, and yet no other cause be found, I advise Fowler's solution of arsenic to be given in increasing doses up to its physiological effect. If the bowels are notably constipated and the liver evidently inactive, I advise Warburg's extract in 5-grain doses three or four times daily. If anæmia be present I advise quinine, iron, and arsenic in a suitably formulated pill, the following being a favorite with me: 1 grain of reduced iron, 2 grains of sulphate or preferably the muriate of quinine, and $\frac{1}{60}$ to $\frac{1}{30}$ grain of arsenious acid three times daily after meals. Of course, if the asthmatic attack be severe, we should also employ our antispasmodic remedies, such as belladonna, chloral, nytroglycerin,

etc., judiciously. We should also permit patients to smoke and inhale from a cigarette d'Espic, datura tatula (Savory and Moore), or of simple nitre-paper. As a last resort, an inhalation of a small quantity of chloroform or a hypodermic of morphine and atropine may become our only satisfactory help in time of greatest need.

As to gout and rheumatism as causative factors of asthma, what should be said? I am in accord with those who find in these constitutional conditions an underlying influence of great power in causing nervous irritability and characteristic appearances of the throat. Wherever we have the clear history of a previous attack of acute rheumatism or gout, and where, in addition, we have cardiac, joint, or renal signs and symptoms which plainly indicate one or other diathesis, we rightly infer many times that the asthmatic attack is of similar origin. Of course, accidental circumstances, such as over-fatigue, errors of diet, exposure to cold or wet, great anxieties or cares, may hasten, or indeed occasion an outbreak of asthma, when without these incidental occurrences the dyspnœic attack would not have shown itself.

To indicate how important it is at times to recognize the inherent gouty poison dormant in the system, so as to effect speedy amelioration or cure of a patient's symptoms, I would refer for a moment to a dear friend and patient now deceased several years. The case was that of a lawyer, eminent in his profession, about fifty years of age, who had on several occasions gouty manifestations of the joints, marked torpidity of the liver, and a considerable deposit of lithates in the urine. For these symptoms he had been to Carlsbad for treatment, and, thanks to this cure and marked abstemiousness in his daily habits, he was able during quite a while to be in a fairly comfortable bodily condition. On one occasion, after a prolonged period of rest from annoying intimations of disease, he was attacked every afternoon at a particular spot, during his walk up town, with marked dyspnœa. To explain it, if possible, the urine was carefully examined, the heart and lungs interrogated, the diet and habits rigidly catechized, without any posi-

tive finding resulting. Despite the trial of various compounds given, so as to meet rationally any hidden or mysterious conditions which nature was holding concealed, my patient's difficulty of breathing was in no sense relieved. Finally, I concluded that renal inadequacy, due to gout, was the efficient cause, and that substances ordinarily eliminated through the kidneys, but now retained in the system, were the explanation of his suffering. Proceeding upon this theory, I ordered colchicine granules, 1 milligramme in each granule, three or four times daily, and very soon my patient was completely restored to health for a time. During a few days following the use of colchicine the urine, which previously had seemed normal, was loaded with lithates, thus showing the action and beneficial effect of the alkaloid. Aside from purely diathetic conditions, it is highly probable that anæmia, accompanied with constipation, dysmenorrhœa, and pronounced general neurasthenia, is more than sufficient to initiate in certain susceptible women attacks of asthma which can only be effectually treated where these morbid states are judiciously dealt with.

As to reflex causes of asthma. In the nose and throat we find morbid conditions, with which we are all at the present time more or less familiar, that occasion it. When they exist it is clearly indicated, as a rule, to do what is essential to relieve them. Thus, if more or less complete occlusion of the nasal passages exists, owing to hypertrophy of the turbinated bodies, a deviated septum, soft gelatinous polyps, or in children an adenoid growth is present in the naso-pharynx, or much enlarged faucial tonsils prevent normal breathing, we cannot feel satisfied with our care of the patient, unless operative interference be undertaken to modify or remove these evidences of disease. While this is true, it should be admitted to-day that several prominent throat specialists have exaggerated, or unduly magnified, the diseased conditions of throat and nose as causative in producing asthmatic attacks. I have in mind a physician of prominence in another city who was greatly annoyed with occlusion of the nasal passages from gelatinous polyps. His periodical attacks of asthma had been

attributed to their presence. They were skilfully removed by a rhinologist, and yet the attacks soon returned with nearly their old-time severity. I had under my care not many years ago a young man, now a promising political leader, whose nose was greatly obstructed by pronounced deviation of the septum. The drill and trephine were used, and fair nasal breathing thus obtained. Despite this treatment, with satisfactory result from the specialist's stand-point, morphine injections, hypodermatically, had to be resorted to on several occasions subsequently in order to afford notable relief to the breathing.

In chronic gastric catarrh, brought on by errors of diet or alcoholic habits, frequent lavage of the stomach and a regulated regimen have in more than one instance afforded great relief to the frequency and intensity of asthmatic seizures. In some instances in which the total acidity of the stomachal contents, taken after a test meal, would seem to indicate, when allied with severe, repeated attacks of gastralgia, a possible beginning of ulcer of the stomach, I have little doubt that a prolonged use of Vichy or Vals water, with an occasional mercurial purgative, not only afforded relief to the stomachal condition, but also lessened the seriousness of the asthma.

We now come to a consideration of what, after all, are the large number of asthmatics we are likely to see. They are the bronchitic cases—cases in which there is also more or less development of emphysema. Taking cold, as it is said, apart from every other consideration, is what seems to the patient the essential cause of his asthma. He will get along peacefully for weeks without any evident pulmonary distress, and then, owing to slight atmospheric changes, wet feet, sitting in a draught, going from an overheated room to the outside atmosphere, very soon he will notice more or less oppressed breathing and all the usual asthmatic phenomena. In very many of these cases, although they may claim that between the periodic attacks they feel perfectly well, yet when they are questioned closely we shall find almost invariably that upon slight exertion they suffer from short breath and cardiac pal-

pitations. If we examine the chest carefully the percussion-note, as well as auscultation, shows here and there patches of pronounced vesicular emphysema. The latter may have developed slowly and insidiously; nevertheless, when we watch our patients closely, we shall find that the emphysema extends and involves more lung-tissue with the recurrence of each asthmatic attack. The development of the emphysema in its initial stage is not, however, always obscure or uncertain. Very often, and particularly in children, whooping-cough, croup, enlarged tonsils, acute bronchial catarrh, may have previously existed and are quite sufficient to occasion a slight organic condition of emphysema. Where the emphysema is present, recurrent attacks of acute bronchitis are apt to follow for a very slight cause. The mere fact, for example, of the inhalation of an impure atmosphere for a short time will frequently cause the development of bronchitis. If we listen to the chest we shall find sibilant and sonorous rhonchus in abundance, varied at times with moist sounds, even though the secretion is often in small quantity (frothy or viscid), which leaves us in some degree of uncertainty as to the precise condition of lung-tissue.

If the lung, instead of being of good resonance (not to say hyper-resonant), becomes, in special areas at least, dull and non-elastic, does not expand as it should, and we also have muffled or bronchial voice and whisper, we are often undetermined in our judgment as to how much pulmonary tissue is involved.

We are also in doubt as to the pulmonary condition in regard to inflammation. Have we to do with broncho-pneumonia affecting one or more lobules; have we a local atelectatic condition due to the plugging with hard, inspissated mucus of a large or small bronchial division? Is it only increased pulmonary congestion accompanying bronchial inflammation? Or, and especially when the râles are superficial and moist, are the pleural surfaces somewhat inflamed, and do their contact and rubbing together give rise in part to the stethoscopic signs we surely find? These and other ques-

tions are clinically most difficult to decide and except for the *ipse dixit* which at best conceals ignorance, I believe that most men of large clinical experience will re-echo my expressed thought. Of course, the presence or absence of fever, the number of leucocytes found in a careful blood-count, the local pain felt during respiration and cough will not infrequently help us very much to reach a rational and tolerably satisfactory judgment. Where the bronchitis is clearly defined and the secretion slight, our main effort should be to stimulate the latter by appropriate means, and here I find small repeated doses of ipecac., tartar emetic, grindelia robusta, chloride of ammonuim, and iodide of potassium very useful. Where the bronchitis is also evident and yet there is much bronchial secretion, belladonna or atropine must be combined in small or moderate doses with the drugs previously named, or be given with a little camphor and quinine in capsule or tablet form, or else, what is often preferable, simply alone, until their physiological effect becomes manifest. Where the emphysema and bronchitis are clearly defined, and where the asthma is also pronounced and threatening, we cannot wait always for the relatively slow and continuous effects of the drugs referred to, and here, again, we must have recourse for temporary results to inhalation of the fumes of the different antispasmodic cigarettes, of the leaves of stramonium or tobacco, the repeated use of oxygen gas, the timely administration of Hoffman's anodyne, alcohol, hot coffee, capsules of ether or chloroform, etc., always remembering that in very many cases nothing will give relief even for a while, unless it be chloroform by inhalation or morphine hypodermically.

Where, in connection with the previous conditions, we have evident cardiac distention, as shown by increased area of dulness, epigastric beating, distended jugulars, rapid, depressible, weak, sometimes irregular pulse, cyanotic lips, face, and finger-tips, we must recur to the use of nitroglycerin or the nitrites in frequently repeated doses; or to a soluble salt of caffeine (salicylate), either by the mouth or hypodermically. Occasionally blood-letting by bleeding from the arm or the use of

leeches, or wet-cups to the chest or epigastrium, will afford relief more or less lasting, according to circumstances. Usually, I regret to say, the relief is only temporary, and the weakened, distended right heart is soon again powerless to struggle against the ever-present conditions of lung involvement and vascular and nervous paralysis. It is specially under these conditions that we must be particularly careful in our use of a remedy like nitrite of amyl when used by inhalation, which instead of affording marked relief by relaxation of the arteries only seems to occasion further and more intense pulmonary congestion, and thus adds an additional obstacle in front of a right heart already overtaxed. Within a few weeks of writing this I have had occasion to notice these dangerous effects. In the case of an old asthmatic patient who was suffering, and from whom I was desirous of withholding a morphine injection in the fear that it be repeated too frequently and thus give rise to the morphine-habit, the rapid inhalation of only three minims of nitrite of amyl increased the dyspnœa suddenly to a most alarming degree. The veins of the neck became largely distended, the face intensely cyanosed, the eyes suffused, glassy, and so prominent as to appear to start from their cavities. Frequent and labored breathing developed immediately, followed by repeated efforts of expectoration, during which sputa, partly frothy, partly thick, and mucopurulent, were expelled with great difficulty. All these and other serious symptoms gave rise to a graphic and distressing picture not soon to be forgotten. In a short while, however, thanks to the timely help afforded by a hypodermic of tincture of strophanthus, there was a visible temporary amelioration. Despite my best efforts, however, the patient failed rapidly, and died a few days later. At the autopsy the most marked pathological feature of the case was the advanced degree of pulmonary emphysema. In one spot on the anterior border of the right lung evidently one or more of the marginal vesicles had been ruptured, and I noticed a very large sac filled with air and surrounded by the visceral pleura. The sac itself was equal in size to a turkey's egg.

One of the difficult matters to decide in the treatment of asthmatic attacks is when and how frequently we should give morphine injections hypodermically. In the majority of cases that have come under my care I am confident that no remedy will give such immediate and considerable relief to the acute suffering. On the other hand, we have the just dread of beginning a habit so pernicious and so difficult to cure, if once established, that I am compelled to counsel great care in its use. This counsel is eminently wise for attacks, even though severe, that are often repeated.

Again, it should be known that morphine injections will not invariably afford relief. There are times when morphine in any ordinary dose will aggravate rather than subdue the attack, and even add gastralgia to the intense dyspnœa from which the patient is already suffering so much. When, moreover, the patient's urine contains an appreciable amount of albumin and affords other evidences of nephritis, it is often very hazardous to recur to the use of morphine. This is particularly true where the pupils are notably contracted. I have good reason to believe that by administering morphine under like circumstances we may precipitate a rapidly fatal uræmic attack.

The question of change of locality is frequently one which arises and which is so difficult to solve. In general, I would have my patients seek atmospheric conditions quite dissimilar to those in which the attack originates and continues despite watchful care. If the patient be resident of a city or large town, first of all I should have him change his neighborhood for awhile, and often even this slight change is useful. If this prove unavailing, and he be living near the coast, I would have him go to some healthy inland place of moderate elevation, free from dust and cutting winds, if possible. If the town be inland where the person first becomes a sufferer, I should strongly insist upon a prolonged stay by the sea. And yet I regret to add that all my efforts in this direction are often unavailing and the patient continues to suffer about in the same way, no matter where or how often he changes the medium in which he lives. There may be, and often is tem-

porary relief. Quite frequently I learn with great satisfaction that the patient has obtained just what he most desired, viz., relative great quiescence from suffering, or, indeed, the diminished frequency of the attacks. Unfortunately, I cannot count upon this well-being as durable, and sooner or later the asthma is prone to return with its former intensity. Personally, I am inclined to believe, after considerable experience and reflection, that the climatic conditions which shall prove best for any particular case of subacute or chronic bronchitis are also those best suited to the bronchitis when complicated with asthma.

DISUCSSION.

Dr. F. I. Knight: I think Dr. Robinson has done a good service now and heretofore in calling attention to the constitutional element in cases of asthma. The gouty or the malarial condition which is often the excitant of the attack is undoubtedly often neglected. It seems to me that asthma is a very complex thing. Asthma is due, first, to an underlying neurosis; and second, to some lesion in the bronchial tract, I think almost invariably, if not always; and, thirdly, to some excitant. In treating the paroxysm, if we can relieve or modify any one of those factors we can stop the paroxysm. I had a patient who could always relieve an attack of asthma by gambling for high stakes. It is possible, in certain cases, to change or alter the organic lesion; but we can remove the excitant, or remove the patient from the excitant. Englishmen who are subject to asthma will relieve it at once by going from the country down to the city. I know a patient who always has asthma in one hotel in Boston and never has it in another, and the hotels are within a block of each other; and no one has been able to tell the cause. So we have these various factors on which we may work in the interval. The gouty or malarial constitutional condition which I consider the excitant may be so modified that the patient's attacks may be relieved; so it is with those cases where an organic lesion in the upper part of the respiratory tract acts by reflex on the air-tubes below. Often when polypi are removed there is only temporary relief, and then some other irritant comes in by reflex or otherwise. I might mention here the theory of Berkart, that the lesion of 90 per cent. is in the lungs, and comes from measles or whooping-cough or other inflammatory affections of childhood. Dr. Hyde Salter put the proportion at 80 per cent. I think

this may be an exaggerated statement, but since reading it I have traced a large number of cases back to inflammatory conditions in childhood.

In regard to the bronchial cases and their relief, I should, perhaps, urge more strongly than Dr. Robinson the value of the iodide of potassium. No one remedy has served me so well as this.

In the emphysematous cases there is one thing which above all should be insisted upon, and that is rest. The patient who has been miserable with repeated attacks of asthma at night for weeks and months, may be, perhaps, relieved for considerable time by restricting his movements and administering strychnine freely.

It is an interesting subject, but certainly a very perplexing one, and worthy of a great deal more study than is usually given it; and if men will take the pains to investigate individual cases and not consider them simply cases of asthma and treat the name, but will try to get at the conditions which underlie them, they will have much better results in their attempts at treatment.

Dr. V. Y. Bowditch: It is an interesting fact to me that not many weeks ago Dr. A. C. Klebs, of Chicago, lately of Citronelle, Ala., told me of some striking results from the use of diphtheria antitoxin injections in cases of asthma, at the suggestion (I think) of Revillod, of Geneva. Although very skeptical as to its efficacy, he had tried it in the case of a young girl, about ten years old, who had been subject all her life to attacks of asthma. In her case he had used it once or twice with apparently very marked benefit. The patient is really too young to have the mere moral effect of trying a new remedy in such cases taken much into consideration.

In another case very marked improvement was noticed in a lady who for years had been a great sufferer, and had tried almost every known remedy. The good effect of each injection, moreover, lasted many weeks, and at last accounts she was better than for many years before. I give these suggestions for what they are worth without further experience. They come from a careful and cautious observer, not easily convinced of the efficacy of new remedies, but who was at the time certainly impressed.

Dr. Frank S. Johnson: I wish to add my testimony to what Dr. Robinson has said about the condition of constitutional infection, and the necessity of determining primary cause. But, in almost every case of asthma, whatever the primary cause may be, we have to deal with bronchitis and spasm, and in order to obtain prompt satisfactory results, no matter whether the primary poison is eliminated or not, we must direct the treatment temporarily to the immediate disturbance. I concur most fully with what Dr. Knight has said, that the most important remedy is iodide of potash. It should be given in moderate doses, continued for weeks or months, if need be. The

relief of the paroxysms is the important thing in the patient's extremity. In mild attacks this may be accomplished by the administration of belladonna and chloroform internally. Chloroform given internally acts more slowly than by inhalation, but the action is more prolonged, and it is safer. In severe paroxysms the nitrites are often very useful. I prefer nitroglycerin. Its action is very prompt, almost as prompt as nitrite of amyl. The vasomotor effect of one one-hundredth of a grain can often be felt within two minutes. The dose may be repeated every ten to sixty minutes as required. Nitrite of amyl is much more dangerous in the hands of the patient than nitroglycerin. Morphine is safer and more useful than the nitrites in asthma with greatly embarrassed right ventricle.

Dr. J. B. Walker: I would like to refer to one climatic factor that is within every one's reach everywhere. This is sunlight. A patient living on one side of a street may be exempt from asthma, while on the other he may be affected. This may be due to the fact that on one side he lives in a shady room, and on the other side in a sunny one. This is a factor of no small moment in not only the asthmatic, but in all subacute and chronic bronchial disorders.

Dr. R. G. Curtin: Dr. Walker's remarks about a person being able to live on one side of the street and not on the other recalls to me the history of a case. Some of you probably know that Market Street in the past was supposed to be the dividing line between the older and the newer society of Philadelphia. A man who lived on Walnut Street at that time found, that if he walked across Market Street toward the north he would instantly have an attack of asthma, which was relieved by returning to the south side. Dr. Knight's patient reminds me of a confirmed asthmatic who, whenever he had a severe attack of asthma, was always relieved by sitting on a chair in a cool damp cellar when the day was hot and dry.

Dr. Jacobi: I think, Mr. President, the ground has been gone over pretty thoroughly, and nothing has been left untouched. Reflex neurosis, particularly nasal, I have myself charged with being the occasional cause of asthma, but I know that the large majority of cases of asthma I have seen were connected with bronchitis. There is rarely a case that will not exhibit the symptoms of diminished respiration and some dulness over small parts, very frequently over large parts, generally posteriorly and over the lower lobe. It is mainly these cases that are benefited by iodide of potassium. They are not so much affections of the mucous membranes as of the connective tissue of the bronchial tubes and their surroundings, with thickening of the walls. The term peribronchitis has been dropped by a great many, but I think it is a good word to show exactly what it is meant to signify. As the attacks mostly come in the night, I do not hesitate to give a dose of morphine, with or without chloral hydrate, every

night for a long time, and not infrequently it will be the first step in the treatment of a cure. I give good doses, always the same. I never had to increase it, and never developed a case of morphinism in an asthmatic person so treated. Then, it is necessary that the window should be open enough to admit air. The attacks come on when there are carbonic acid and other poisonous gases in the air, when the medulla oblongata is over-supplied with carbonic acid and under-supplied with oxygen. As far as emphysema is concerned, it may be sometimes incurable, but it can be benefited a great deal. One other thing: let your patients be practised in forcible expiration, which may be helped along by compression of the diaphragmatic region, according to the plan of Gerhardt and others. The patient may use a towel for that purpose, which he works himself. An additional help for the purpose of improving expiration is snuff. I make the patient sneeze very hard four, five, ten times every day—a very satisfactory method, and not very expensive.

Dr. J. H. Musser: In the management of this affection reference has been made to, and I concur in the necessity of, hygienic and largely to dietetic measures for its relief, not excepting climatic influences. With regard to remedies, asthma is the disease which exemplifies the law that the more incurable the disease, the more remedies there are for the affection. It certainly is a disease that requires the study of each individual case. I am satisfied in a number of cases, as Dr. Jacobi remarked, that sedatives are very beneficial. I am sure I have seen, barring the fact that the disease may probably have disappeared independently of my management, one instance in which the use of morphine every night, hypodermically given, cured the patient. The object was to anticipate and prevent the occurrence of the paroxysm. The patient was in the family of a physician, and the physician was able to watch the effects, beginning at first with doses sufficient to control the spasm, and each night to lessen the dose until finally the patient was able to do without the morphine, when the paroxysms had disappeared.

I do not fear in asthma, barring that form of asthma which is purely a neurosis, the development of the morphine habit; in fact, I have never seen (although I have seen a large number of cases) the morphine habit occur in asthmatic subjects. I think it is a very good rule to keep in mind in the management of all cases, that in the neuroses we are liable to create the morphine habit, but rarely in organic disease, as rheumatoid arthritis and other conditions of that kind, is it likely to occur. I have also used iodide of potassium, varying the dose with the individual and increasing it until we get a physiological effect of the drug. In the cases in which operative measures are first resorted to, if we follow immediately after the operation with the use of the drug we can prevent that recurrence

which often does unfortunately take place. In bronchial affections and particularly in the class of cases where, in early childhood, there were inflammatory conditions, iodide of potassium seems to be of a very great advantage.

Another group of drugs which, in some instances, serve me well are strontium salts and nux vomica. Nux vomica has been very satisfactory, continuing it over a long time. Such dose is given that produces physiological effects, then reducing the dose, bearing in mind that always the patients become accustomed to the remedy. From time to time you may increase the dose in order to get its effects. In this manner I have had patients take as much as one hundred drops of tincture of nux vomica three times daily. In another instance with the nux vomica given in this manner and the morphine at night, watching the effects and gradually diminishing the dose of morphine, I have one patient absolutely cured. There may be other drugs that from time to time may be of use, but these are the remedies which occur to me.

We must not forget in the treatment of asthmatics the value of inhalation, and especially of treatment directed to the local condition. In examining the sputum of many of these asthmatic patients we find the infection of streptococci, indicating that there is a localized infection. These cases I am sure are the most difficult to manage, and for them we must resort to climatic influence.

Dr. Blackader: We all agree, I am sure, with Dr. Musser in emphasizing the importance of first removing, as far as possible, any reflex source of irritation, and then carrying out a vigorous constitutional treatment of the disease. Personally I agree with him as to the value of morphine in relaxing spasm, if employed with caution over short periods of time; but I differ from him when he minimizes the danger in these cases of the morphine habit. There is, however, another drug of which I stand in still greater dread. That drug is cocaine. Two patients of mine who, to obtain relief from a troublesome bronchial asthma, were sent to climatic resorts in the South, returned slaves to the local employment of cocaine. When nasal troubles exist, the relief that cocaine affords is prompt, but only temporary. In the end it unquestionably increases the local damage; more important still, it ruins the patient morally. As a Society we should raise our voice in condemnation of its use.

Dr. W. D. Robinson: Exhibition of iodide of potassium causes gastric distress and nausea. When given in junket it can be safely taken without trouble, and the doses largely increased.

Dr. Musser: I want to endorse what Dr. Blackader said in regard to cocaine. It is infinitely more dangerous than morphine.

Dr. Coleman: I want to speak in corroboration of what Dr. Blackader said concerning the use of cocaine. I have a patient now

under my care who has become addicted to the cocaine habit by using it as a spray, and he uses as much as an ounce of the crystals in two or three days. I do not know of any such amount ever having been taken, but he has reached the point where he can scarcely go for fifteen minutes without using the spray.

Dr. E. O. Otis: Reference has been made to the beneficial effects of removal from one room to another, and from one side of the street to the other. As illustrative of this, a case occurred to me a few days ago where the asthmatic paroxysms were most severe and distressing, and in relieving which all the ordinary and extraordinary methods of treatment failed, including subcutaneous injections of morphine, and momentary relief was only obtained by the inhalation of ether. The removal from one room to another and the substitution of pillows made of other material for feather ones, appeared to be the determining factors in relieving the attack.

Dr. Robinson: I have two things to say: one is for the people; I trust that if any ladies and gentlemen who are now in this fair region have been willing to listen to what has been said, they are also willing to recognize that it is wisdom to take no panacea for the relief of asthma, but to put themselves in charge of a far-seeing and intelligent physician.

One point not referred to in my paper is a question in regard to the use of morphine. I have been on the lookout for it, but have not yet struck it. A point I made was in reference to the use of morphine injections in uræmic conditions, and as to when we could use morphine injections to break up uræmic convulsions, and when not. We all know that the late Professor Loomis certainly acted in a very able and in a very satisfactory manner when he showed us in that certain acute conditions there was nothing better to break them up than injections of morphine; but we also know that in certain cases of chronic nephritis it is a very dangerous remedy. In looking over Dr. Loomis' cases I notice that in every instance, without exception almost, where it is mentioned, the pupil is indicated as being dilated. Wherever the patient is shown to have kidney trouble I always look at the pupil before I give my hypodermic of morphine. If contracted I will not give it. In chronic asthma recollect that we have to do with people of a certain age and a certain amount of interstitial nephritis. Many have a certain amount of albumin in the water. I think that the question of whether they have interstitial nephritis will depend upon the specific gravity of the urine. We are not always able or ready to make a careful urinalysis and estimate quantitatively what there is to be found, and I simply direct attention there. Knowing as we do that the interstitial nephritis probably exists, and with an interstitial nephritis that there is a considerable risk at times in giving morphine injections, let us be a little bit careful.

ERGOT IN CHRONIC MALARIA.

By A. JACOBI, M.D.,
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THESE notes are written exclusively for clinical purposes. That is why a few words on the active principles of ergot may suffice. They are sphacelinic acid, cornutin, also trimethylamin, vernin, and ergotinic acid. Trimethylamin gives rise to cerebral spasms, which may become tetanic. It increases reflex irritability, and, according to Gaethgens, accelerates, by irritation of centres located in the medulla oblongata, respiration and blood-pressure. Vernin, which was found by Schulze and Bosshard, is a new xanthin substance, with effects similar to those described above. Sphacelinic acid (spasmo-toxin, sphacelotoxin), so called by Kobert, who first studied and named it, when absorbed in the intestine causes a hyaline degeneration of the bloodvessel-walls, which first contract and finally dilate; also coagulation inside the vessels with consecutive gangrene. In proportion to the doses taken it causes paræsthesia, alopecia, falling out of the nails, and gangrene of the skin of the extremities. Fortunately, it is easily decomposed, so speedily indeed that ergot a year old contains none at all. The effective principle is cornutin, found and named by Kobert. What Tanret called ergotinin is chemically identical with it, but does not equal it in efficiency when prepared according to Kobert. It is easily decomposed when exposed to light or air. There is but little of it in ergot, all the alkaloids forming but 0.2 per cent. of the drug. It irritates the medulla oblongata, contracts the arteries, increases blood-pressure, and contracts the unstriped muscular fibre in general. It is employed as a

citrate or a chloride. Kobert speaks of it as inclosed in capillaries holding 0.005 for subcutaneous use, or in pills of 0.002. In Merck's *Index* "cornutine" and "cornutine citrate" are enumerated. In poisonous doses it causes convulsions and contractures, also toxic polyneuritis such as follows overdoses of arsenic, lead, phosphorus, alcohol, or mercury. Ergotinic acid, called sclerotinic acid in its impure state, lowers the blood-pressure in animals. Before knowing better, I recommended it, even in my *Therapeutics*, for subcutaneous injections to obtain the effect of ergot; that was a serious mistake. In the intestinal tract it is decomposed, and under the skin it is painful and irritating.

All of these constituents lose their power while in the ergot, from month to month. It should be gathered before the rye is perfectly ripe for harvesting, but generally is not. The decomposition of the grain is mainly due to its large percentage (39) of fat; that is why a salutary effect is often missed, and the opinions in regard to the efficiency of the drug differ. The effect of the extract, or fluid extract, depends on the retention of the cornutin. All such preparations as are deprived of the substances soluble in alcohol are deteriorated thereby, for it is the active alkaloids that are soluble in alcohol. In the fluid extracts the alcohol should be strong enough to hold the alkaloids and dilute enough to dissolve but little of the fat. As far as I am concerned, I have employed for internal use, whenever possible, the solid alcoholic extract of the Pharmacopœia. It seemed to me to give better results than even Bonjean's ergotin, which has been in the market since 1842. At all events, the value of ergot preparations is in their undecomposed alkaloids; everything else is either indifferent, disturbing, or injurious.[1]

The effect of ergot and its preparations, when given in medicinal doses, is mainly spent on the unstriped muscular fibres. Its effect on the uterus has been known and used and abused a long time. The muscles of the vagina were found to

[1] Kobert: Lehrb. d. Pharmako-Therapie, Stuttgart, 1897, p. 502.

be influenced by it by Swiecichi.[1] That is why I felt encouraged more than forty years ago to administer it in conditions of hyperæmia and in the acute and subacute inflammations of such organs whose bloodvessels are not entirely or almost deprived of muscular layers. The media of small arteries have unstriped muscular fibres. There are several of these layers in the larger ones, which besides are supplied with elastic fibres. This structure is uniform in all the arteries of the body. The veins, however, exhibit more startling differences, nowhere more than in the tunica media. It consists of circular muscular fibres, elastic network, and fibrillar connective tissue, is best developed in the v. poplitea and the other veins of the lower extremities, less in those of the upper extremities, still less in those of the abdominal cavity. It is *absent* —and here is an important point—*from the veins of the pia and dura mater,* of the retina and the bones, the vena cava, and all the veins emanating from the capillaries, where the media consist of transverse and oblique bundles of connective tissue only.[2]

As I said, the veins of the pia and dura have no muscular fibre in the media; moreover, in the cranial cavity they are long and distant from their arterial pressure-supply. That is why I am never surprised when the employmont of ergot in brain disease is wholly futile. Circumstances are different in connection with the spinal canal. The veins of the cord and its membranes are no better supplied with contractile elements than those of the cranial cavity; but because of their shortness they are under the immediate influence of blood-pressure. That is why ergot, so useless in brain disease, is perfectly adapted to cases of spinal hyperæmia or of acute or subacute spinal inflammation.[3]

[1] Quoted by Kobert: Intoxicationen, 1893, p. 185.

[2] Ph. Stoehr: "Histologie," seventh edition, p. 91.

[3] In hemorrhages, such as those of the lungs, ergot has long been used by some with great confidence, by others with indifferent success. Among the latest preparations is ergotinol, of which 1 c.c. corresponds to a gramme of extract of ergot, which Vosswinkel eulogizes highly in pulmonary hemorrhages when used subcutaneously. Some think highly of ergot in all sorts of inflammatory processes. There is Croq, of Brussels, for instance, who employs it in tuberculosis. In his opinion the tendency

The practice of employing ergot in spinal cases was gradually developed. In a report, published in the *New York Medical Monthly*, during the years 1860 and 1861, on my clinic of the diseases of children in the New York Medical College, then in existence, you may find a few of my earlier cases in which I employed ergot for the purpose of contracting bloodvessels and relieving the hyperæmia and inflammation of spinal diseases.

No. 68 is a case of acute poliomyelitis; No. 122, one of spinal meningitis; No. 167, one of spinal hyperæmia. As far as I know, they are the first I published after some years of experience with the drug. In regard to the latter disease, my information was obtained from a friend who at that time was stationed at the Emigrant Hospital of Ward's Island, Dr. Francis Simrock. Some histological considerations encouraged me besides in employing it in this way. The capsule of the spleen consists of dense and hard connective tissue, unstriped muscular fibre, and an elastic network. It sends off numerous processes, leaf- and string-like layers, into the interior of the spleen, thus forming a coherent network, which contains the pulp. This network also contains, besides connective tissue, copious unstriped muscular fibres. Thus it seems there is no organ in the animal economy more amenable to the action of a muscle-contracting agent.

The employment of ergot in moderate doses has no dangers under the most ordinary circumstances. I have used it these forty years extensively, for weeks and even months in succession, without a single case of intoxication. The latter has

of tuberculosis is rather that of getting well, unless complicated by inflammatory processes, to counteract which no medication seems to be more indicated than that of ergot. Certain forms of spermatorrhœa and nocturnal enuresis connected with muscular incompetency of the sphincter are frequently benefited. Here its effect may be the direct one on the unstriped fibre, or on the spinal centre of the sphincters, which must be taken to be present in the lumbar cord along the uterine and spermatic centres. It has been given in Graves' disease for the same reason, not to speak of, for reasons unintelligible to me, its use in non-pancreatic diabetes mellitus, sea-sickness, and whooping-cough. In the paralytic form of hemicrania it has been highly recommended, and maybe all of us have employed it. In tabes, in spastic spinal paralysis, in progressive bulbar paralysis, it has been used because of the supposition that the anatomical lesion is attended by dilatation of the bloodvessels. The results are but few or none. At all events, no physiological effect can be expected except in the initial stages, when there still is or may be spinal congestion.

frequently been observed in all countries in Europe, mostly in the past. If we hear of epidemics or endemics of ergotism, there are but few countries in which they are often met with—viz., Spain, and still more, Russia. With the increase of civilized agriculture and a slight improvement in the general condition and nutrition of the population, the average of good rye increases, that of ergot decreases. In every harvest of corn there is some ergot; 1 per cent. is common and not attended with danger. But when a population is starved and subjected to malaria and other infectious diseases, and unclean and sleepless from hard work, starvation, and anxiety, and when they are fed on rye with a large percentage of ergot, and particularly when it is of recent growth, during a very few months after cutting, ergotism may make its appearance.

There is danger in poisoning only, not in medication. In connection with malaria there are two organs we have to consider when medicating—the blood and the spleen; the former because it contains the sporozoa, the latter because of its sponge-like mass in which it harbors the infected blood and serves as a receptacle of dangers. It appears that a direct effect on the blood or on the plasmodia is not required for a cure, but that the gradual restoration of the spleen to a fairly normal size, forcing the stagnating blood into a normal circulation with progressive elimination of the plasmodia, is sufficient to open the gates to recovery. That is what I believe I have often done by giving ergot in malaria.

The uncertainty of the effect may also be due to the fact that most preparations of ergot contain both ergotinic acid, which lowers arterial pressure, and cornutin, which contracts the arteries. All of this should impress us with the necessity of using the alkaloid cornutin when it is obtainable. Even this substance should be used with great care—for instance, in hemorrhage, which may be increased by heightened blood-pressure.

Case I.—A Hungarian boy, aged five years, just arrived in the country, October 10, 1859. Had fever and ague, mostly quotidian attacks, at his home. On the ocean he was better—

that is, now and then he had a day without an attack. He was pale, waxy, with extensive hæmic murmurs and with albumin in the copious and watery urine. His spleen extended nearly to the spina anterior superior. Had regular daily attacks with great prostration, in spite of quinine and Fowler's solution. Of the former he took from six to twelve grains daily. Being previously constipated, his bowels had been attended to. Not being acquainted with the fluid extract (perhaps it was not even in the market[1]), I gave him an infuso-decoction, prepared with sulphuric acid, of half an ounce of ergot in ten ounces of water, of which he was to take one-half tablespoonful three times a day. There being no improvement, he took, after four days, the same dose five times a day. When I saw him ten days later he had been without an attack three days. The doses were continued five days, then for five more days four daily doses were given, and thereafter but three. During all this time he had no attacks of fever, albumin became less, but his spleen was still as large as before under percussion and palpation. Finally he was removed from South Brooklyn, where Gowanus Bay was as pestiferous at that time as the shores of the River Theiss, and gradually, with the use of iodide of potassium, iodide of iron, and the occasional resumption of ergot, he improved. After a year I saw him again, looking well but pale, with no albuminuria, hardly any murmur, but his spleen was still palpable three centimetres below the border of the ribs.

Case II.—His brother, sixteen years old, gave me a new experience. He had the very same symptoms exhibited by his brother—hydræmia, tumor of the spleen, etc., without albuminuria and without the history of chills. For the latter reason he had taken no medicine whatever. After purging him gently I ordered the same medicine to be taken in tablespoon-doses four times daily. Two days after beginning this treatment he had a very violent chill, followed by perspiration; no temperature was taken, as he was miles away. He had another

[1] Dr. E. R. Squibb, in a letter dated September 21st, has kindly informed me that it was first prepared by Prof. Wm. Procter, Jr., of Philadelphia, in 1857 (Proc. Amer. Pharm. Assoc. for 1857, p. 130, and 1859, p. 271), and by himself since 1859.

violent attack the next day, a milder one a few days after this, and then no more. He was treated like his brother, with the same slow but finally satisfactory result.

Case III.—A. W., male, fourteen months old, was seen by me October 1, 1880. Was breast-fed until half a year previously, then fed on mixed food. Had diarrhœa in the summer, and fell ill with pneumonia of the right side a fortnight before I saw him. This was watched carefully; I found but few remnants of it. But in the beginning of the second week the baby was taken ill with a convulsion, high fever, and vomiting; lips and fingers were bluish. After a few hours the condition improved, but on the following day blue nails, high temperature, followed by apyrexia, and great debility were noticed. No return of pneumonia; no nephritis. Quinine was given in repeated doses for several days. No convulsion returned, but there were temperatures up to 102° and as low as 97° F. every day. The urine was pale all the time; more was passed during the high temperature; none during apyrexia. On October 1st this condition, of somewhat elevated temperature every day, which lasted a few hours, continued in spite of from 30 to 40 cg. of sulphate of quinine. There was no apparent reason for changing the medication, but care was taken to give the quinine doses during apyrexia, and not within the last three hours before the expected attack. Up to October 5th there was hardly any change in the daily recurrence of temperature. The spleen became palpable and appeared sensitive on pressure; meanwhile no anomaly of heart, lungs, or kidneys. Quinine was then stopped, and fluid extract of ergot given in six, after five days, in five, after ten days, in four, daily doses of ten minims each. On and after October 7th no attack of fever; on the 10th the spleen could no longer be felt. Ergot was continued to November 15th, and Fowler's solution and syrup of the iodide of iron were given from October 15th to the end of the year.

Case IV.—Mrs. M., thirty-one years old; in moderate health until the summer of 1890, though she lived in East 117th Street, New York, a hot-bed of malaria even at the

present time, until August, when she moved to Brooklyn. The only exception to her average health consisted in neuralgic pains of uncertain duration and at irregular intervals. Left hemicrania she had had for years, neuralgia of the left upper extremity during the summer, and for several weeks before she presented herself on November 24, 1890, neuralgia of the right lower extremity, posteriorly. This pain grew worse from slight pressure; deep pressure would diminish it. She had an extensive and loud systolic, a mild diastolic, murmur, no enlargement of the heart, pale lips and conjunctivæ, and a small pulse of 80. She had suffered from chills and fever since September; the tertian type had changed into the quotidian after a week; later she had two attacks a day. They would intermit now and then after heavy doses of medicine. During the previous fortnight she had taken 400 grains of quinine, and had almost daily attacks; she had a chill with a temperature of 104.4° F. in my office. Her spleen was 15 cm. long, 8 cm. wide, and sensitive over such of its surface as could be palpated. She was ordered to go to bed for at least a week, and to take 0.5 of calomel; at the same time a teaspoonful of Squibb's fluid extract of ergot four times a day in whiskey and water. When, after three days, her chills continued, the dose was given six times a day, and no chill occurred after the fifth day until she presented herself on December 3d, nine days after her first call. Her spleen was 3 cm. shorter and less sensitive. She then was ordered 0.75 of sulphate of quinine once every fifth day in the forenoon, and the ergot was continued in the same doses. On December 7th she had a slight chill while still in bed in the morning. On December 10th the ergot was reduced to 15 c.cm. a day, in four doses; on the 20th to 10 c.cm. On that day her spleen could still be felt slightly below the ribs. The quinine was continued to about the middle of January; the ergot another month afterward. At the same time, from December 20th to the end of January, she was given iodide of potassium (5 grammes) three times a day.

Case V.—M. H., twenty-six years old, was admitted November 11, 1897, and discharged December 6th. Was a

moderate drinker and not venereal; had no previous sickness. After a two-weeks' sojourn in the South in September he had one morning a chill which lasted one-half hour, and was followed by perspiration. Such attacks he had every other day for two, then every day for three, weeks. Quinine was taken, and the type of his fever became tertian again. Lately, while he was still taking quinine—mostly, he said, when the chill came on, and enough to affect his hearing—the type of his fever became mixed, sometimes every day, sometimes every other day, with a few intervals of some days. On the 11th of November his temperature was 100.4° F. at noon; a chill came on at 2 P.M., with a temperature of 103.2° and 104.4° F., which sank gradually. His spleen was quite tender on pressure below the ribs and up in the seventh intercostal space, and was about 13 or 14 cm. long, as revealed by percussion. Plasmodia were found in large numbers. Squibb's fluid extract was given in four daily doses of a teaspoonful (4 c.cm.) each. The highest rectal temperature of November 12th was 100.8° F. at 2 P.M.; of the 13th, 99.4° F.; of the 15th, 99.2° F.; of the 16th, 99.8° F. No chills. Did not feel quite well on the 20th, and was given a few teaspoonfuls of sodium sulphate. Highest temperature 99.6° F. at 8. P.M. Because of indigestion, with coated tongue, took sulphate of magnesium on the 21st. Temperature 101.2° F., but no chills. Spleen smaller, less sensitive; plasmodia still found occasionally. Highest temperature on the 22d, 101.8° F.; on the 23d, 102.2° F.; on the 24th, 101.8° F.; on the 25th, 100° F.; on the 26th, 99.8° F. During all these days he never had abnormal temperatures like those he exhibited while under the uncontrolled influence of his malaria, but normal they were not. Evidently the rise extending over days was due to an additional, probably, gastric influence. About this time plasmodia disappeared from his blood. He remained under observation more than a week, and was then discharged.

Case VI.—T. B., twenty-eight years old, admitted May 10th. Had had syphilis nine years before, gonorrhœa several times; was otherwise healthy with the exception of slight colds;

drank "some." His feet had been swollen a little for seven months. During the previous three months had had chills and sweats, off and on, he said. Took a great deal of quinine, almost daily, which helped him. Temperature, on admission, 101.4° F.; pulse, 118; respiration, 28; pallor, anæmia. Sibilant and sonorous breathing over both lungs, anteriorly; breath diminished over base of left lung posteriorly, with subcrepitant râles and dulness. Liver-flatness from sixth rib downward to below the costal border; the organ was felt 9 cm. below it in the parasternal line. Spleen extended from the seventh rib in the axillary line to the crest of the ilium and to within $2\frac{1}{2}$ cm. of the median line. No œdema; no ascites; kidneys negative; axillary lymph bodies slightly enlarged. Plasmodia found pigmented, flagellated, segmented. Fluid extract of ergot 4 c.cm. four times a day on and after the 12th of May, preceded by a dose of calomel and sodium bicarbonate on the 10th. May 15th: no chill since; no diminution of size of spleen, which feels a little softer. May 23d: was up and about all the week; no paroxysm, spleen softer, no flagellated and no segmented plasmodia. Had no paroxysm to the end of the month. At that time no plasmodia, and spleen was less tense and shorter by almost three centimetres.

These cases are selected almost at random from my records; a great many were never recorded, since my experience with the drug was no longer doubtful. In connection with the subject I may here state that my success with ergot in chronic and relapsing malaria encouraged me to try it in many cases of acute malarial infection. I am certain that many such cases will respond to the action of ergot, but in the average case less rapidly than to that of quinine. Indeed, these experiments were made for the sole purpose of observation.

CONCLUSIONS.

1. There are cases of chronic intermittent fevers, with large tumefaction of the spleen, that after having resisted the action of quinine, arsenic, methylene blue, eucalyptus, and piperine are benefited by ergot.

2. When enlargement of the spleen is not old and not firmly established the contracting effect of ergot is noticed within a reasonable time.

3. The attacks may disappear before the diminution in the size of the spleen is very marked.

4. Though temperatures after the employment of ergot remain irregular and now and then somewhat elevated, chills, as a rule, are not noticed with this elevation.

5. Plasmodia do not seem to disappear from the blood so rapidly as they do after quinine when the latter is effective. But even while some are still present, the attacks being more or less under control, the patient will feel better.

6. Complicated local pain requires additional treatment with ice, or cold douches, or heat; chronic hyperplasia of the spleen demands iodide of potassium and iodide of iron. Digestive disorders may indicate, as they often do when quinine is expected to act, before the employment of ergot, an emetic, or a purgative, or stomachics.

7. An experience extending over forty years, in which I have used ergot in many instances, justifies me in asserting at least this much: that there are many cases of chronic malaria, apparently intractable, that will get well with ergot.

8. There are cases, occasionally, in which the return of elevations of temperature after the successful use of ergot makes the combination of ergot and quinine, or ergot and arsenic, advisable; this medication will prove effective though quinine and arsenic had not been successful previously.

9. Ergot, like quinine, probably by its sudden contracting effect on the spleen, and by the forcing of large quantities of plasmodia-laden blood into the circulation, is, in chronic malaria when hydræmia and spleen-tumor are excessive, capable of bringing on the very first attack of chills and fever.

10. Recent cases of malaria have got better, or were improved, under the extensive use of ergot, but many resisted a long time; that is why acute cases should rather be treated with quinine.

DISCUSSION.

Dr. Judson Daland: I have listened with great pleasure and profit to the remarks made by Dr. Jacobi in reference to the action of ergot in malaria, and I was especially interested in the observation regarding the influence of ergot on the spleen.

In reference to those cases of malaria uninfluenced by quinine, so far as Philadelphia is concerned, we present very few cases that do not yield to the action of this drug. Along the Gulf States, more particularly in Louisiana, I am informed a number of cases have occurred where quinine has not exerted its usually beneficial effect.

One year ago, while in Tiflis at the Civil Hospital, Professor Gurko informed me that frequently they received cases of malaria from the neighborhood of Batoum, on the Black Sea, which were uninfluenced by large doses of the bichloride of quinine, administered by the mouth and hypodermically. He stated that in the few months preceding he had treated in this way six cases. The cases had been accurately studied; the parasite had been pictured, and these pictures were shown to me, and of the six cases he had five deaths. He also stated that many of these cases presented symptoms of typhoid fever before the parasite was found in the blood, but other examinations showed the affection to be malaria and not typhoid fever.

The use of quinine in malaria, as we see it in Philadelphia, sometimes fails to give us results in cases unquestionably malarial, for several reasons. I recollect two such cases in the Philadelphia Hospital where the patients had malaria, as demonstrated by the presence of the plasmodium in the blood. Quinine was given in sufficient quantity, but most of it was recovered in the stools, and I have no doubt that, in many cases of malaria, the quinine is either insufficient primarily, or the pills are old and hard and only partially dissolved, or it is in capsules that are old and pass the pylorus, and probably escape in the feces without the organism being impressed with this salt of cinchona.

With the detection of the plasmodium of malaria the number of cases of malaria in Philadelphia has rapidly decreased until at the present time, except those cases coming from the eastern shore of Maryland and other malarial points, the disease is practically a rare one; and on an average in not one case in ten where the diagnosis of malaria has been made has it been verified by an examination of the blood.

Reference has been made to the time of giving the drug, which is a matter of some importance, and it would seem, from what we know of the disease, that the plasmodium is most exposed to the antidotal

action of the quinine at the time when it has become the matured malarial body floating free in the blood.

It is quite evident that, when the plasmodium is within the red blood-corpuscle, quinine in solution in the plasma would not be able to exert its antiperiodic effect. But when the body breaks through the envelope of the red cell and enters the circulation, quinine promptly destroys this parasite.

I would like to call attention to one case which unquestionably would have ranked a few years ago as a case of malaria. The case presented intermittent fever occurring daily with the customary symptoms of the paroxysms. Repeated examinations of the blood, urine, and viscera gave negative results. Autopsy showed suppurative kidney with calculi impacted in the ureter. It would seem as though these calculi would temporarily occlude the passage of urine from the diseased kidney, but when the accumulation of urine became considerable dilatation of the ureter would take place and partial escape of the pyonephrosis would occur. The urine that upon examination gave negative results was probably secreted from the healthy kidney while there was temporary obstruction of the left ureter. No distinct tumor could be found, although examination was interfered with by the obesity of the patient, and swelling was detected in the left renal region.

Regarding the action of ergot upon the essential poison of malaria, I doubt very much whether it has this effect. I personally have not had much experience in the use of this drug for the reason just stated. As a rule, the disease, as we find it in Philadelphia, yields to quinine and the salt of quinine, which I prefer because of its solubility in the bichloride.

The poison that produces the paroxysm seems to be produced during the growth of the parasite of malaria, and at the moment of its maturity there is thrown into the blood a chemical poison which initiates the paroxysm. I doubt whether ergot has any special influence over this low form of animal life.

Dr. Beverley Robinson: If we look back I think we must all be of the opinion that probably bloodvessels in the different organs are affected; they seem to have a notable effect upon the malarial condition, and, I should imagine, through the diminution of the size of the spleen in old malarial cases. The probability is that quinine does have some contracting influence on the spleen itself in addition to any particular effect it may have upon the blood. With that I can understand that there is a rational view with the action of ergot in regard to the effect of the size of the spleen, and when the spleen comes to be contracted the malarial condition is fatally affected.

I would like to speak of something that I am extremely interested in, and hope some of the gentlemen present will be good enough to

give their opinion. In a paper before the New York Academy of Medicine I called attention to the use of the tincture of bark in repeated doses, and spoke of cases in which it had been notably useful. The cases were pretty closely observed in hospital wards and in my practice outside. If any of you have not read Huxham's original work on the treatment of fevers and his remarks with reference to the treatment of malarial fever, I think you will be very much interested. It was published more than a hundred years ago, and he gives the formula now used. He attributes a certain amount of merit to the snake-root. I believe we are getting away from facts which are of very great value. We are disposed to believe a little too much in using our alkaloids, because they are useful and are so easily given. The bark itself is of very great benefit. I think there is a rational basis of belief that the bark itself will be of use in removing the poison of malaria. The bark must be given in many of these instances if you wish to secure the best effects. I would refer to one preparation by a firm in the West, Parke, Davis, & Co. Compound fluid extract of cinchona is nothing more than the compound tincture of cinchona with five times its strength, so that if you give five or ten minims of the compound cinchona you are giving five times the strength of the tincture. I have found it a very useful way of giving thebark, and have obtained from it very good effects. I trust the members will look around and see if what I have stated is correct.

Dr. R. G. Curtin: It seems to me that the treatment of malaria as suggested by Dr. Jacobi would be a valuable addition to any specific treatment, by not only helping to keep down the size of the liver and spleen during the acute attack, but also preventing the subsequent chronic enlargement of these organs.

Dr. Didama: I live in a region which used to be swampy, and chills and fever were prevalent. Nearly forty years ago physicians treated the cases there by first giving something to prepare the system to take the antidote of the poison. We knew nothing about bacteriology at that time. Physicians were in the habit of giving calomel, etc., to get the liver in good condition before they gave the quinine. I could not see why we should not give an antidote at once, and so at that time I commenced giving that which I have been giving ever since. There was a tendency for the chills and fever to return in about seven or fourteen days. Then I thought, in order to prevent that return, I would repeat the medicine about every six or seven days. So I would give the patient ten or eleven powders, each one containing four, five, or six grains of quinine with piperin and some sulphate of iron. I never varied the size of the dose from that day to this. The patients took the powders without any reference to what time of day the chill occurred. They took one in the morning and one in the afternoon or toward evening. A few of these powders were put

up in blue papers, and the patient was to take one of these every Sunday morning for three or four Sundays. The men kept at work as usual, but there was no return of the disease that season. The next season they might have it again, and it was cured in the same way. I have had from 200 to 250 cases a year. Patients in Michigan took the same medicine with the same result. There were some cases which did not come to me early enough. In these cases of chronic malarial poison, with enlarged spleen, this treatment does not do so well, and I am glad Dr. Jacobi has told us what he has. I thank the doctor for speaking about the action of ergot in eliminating the poison from the spleen.

Dr. Jacobi: There is no doubt that there are cases of malaria that do resist quinine, as there are cases that do resist arsenic, or quinine and arsenic together. I have seen them. If any man says he has not seen them—a great clinician whom I much admire rebukes those who do not succeed with quinine in every case—that is his luck and not mine. The spleen, of which we know almost nothing as yet, has certainly a great influence in harboring germs and in being the cause of the relapses not only in malaria, but in other diseases. I remind you of what we can all see in typhoid fever. I know that in a case of typhoid fever in which on the sixteenth or seventeenth day the spleen does not diminish in size, you will have a relapse or rather a continuance of the illness. In those cases in which the spleen diminishes in size about the sixteenth or seventeenth day we are fairly certain that with the usual care there will be no relapse. That is one of the instances of which I can feel tolerably sure as a matter of experience, which is, that the spleen certainly has a great deal to do with the relapses of typhoid fever. So in malaria, if I succeed in reducing the size of the spleen in a reasonable time I feel sure that the malaria is under control; but in fever districts, in the South as in the North, in the swamps, we have cases that will not easily get well. There are also those very obstinate cases in which the spleen grows very slowly for weeks and months until, finally, cachexia is the first and the "chill and fever" only the second symptom. These cases are very apt to resist the influence of quinine. The practice Dr. Didama speaks of, of giving calomel before giving quinine, and getting the stomach in good order, is a very good one, mainly in these old cases. There are those in which quinine will not act until you get the stomach in good condition for absorption, by a purgative, sometimes by an emetic or by irrigation of the stomach, always by stomachics.

Regarding the preparations that I have used, I can say that I have not given a single sugar-coated pill for thirty years. I seldom prescribe drugs even in capsules, because I know capsules may pass through the intestinal tract. I generally use powders in preference

to anything else, because I feel tolerably sure the quinine will then act; I order solutions only for those who do not mind the taste.

To-day I simply state to you my observations, made during forty years or more, that there are cases of malaria which, after not getting well with quinine or with arsenic, do gradually get well with ergot. Now, there is no reasoning against that. If you always cure your cases with quinine only, so much the better for you. I did not always succeed. After failures I often succeeded with ergot. If some one does not see why that should be so, I cannot to-day disperse his doubts. It is not the first time, nor the last, that empirical facts collided with our insufficient information, and that theoretical reasons would come limping behind actual observations. I tried to suggest the way in which ergot may prove effective in malaria; maybe a better explanation of its action can be found. I believe I am on perfectly safe ground when I display my clinical observations which, as I said, extend over forty years.

AN OUTLINE OF SOME OF THE MEDICAL USES OF THE RÖNTGEN LIGHT.

By FRANCIS H. WILLIAMS, M.D.,
BOSTON.

Mr. President and Gentlemen: In accepting the cordial invitation of your President to read at this meeting, I intended to limit my paper to one disease—pulmonary tuberculosis—but at the very kind suggestion of the President I shall present, instead, a general statement of the medical applications of the x-rays, as being of more interest at this time, and give the results of the clinical observations made in some of my patients, in order to suggest ways in which an x-ray examination may corroborate other evidence or assist us to an earlier or to a more correct diagnosis.

In a general way, x-ray examinations may be said to have thus far been most used to detect foreign bodies, or changes in shape and composition of bones, as in fractures, dislocations, necrosis, tuberculosis, osteosarcoma, deformed pelvis, rickets, and osteomalacia.

Gouty deposits about the joints, as shown by Dr. Arthur L. Fisk, are distinguished from rheumatoid arthritis by means of an x-ray photograph.

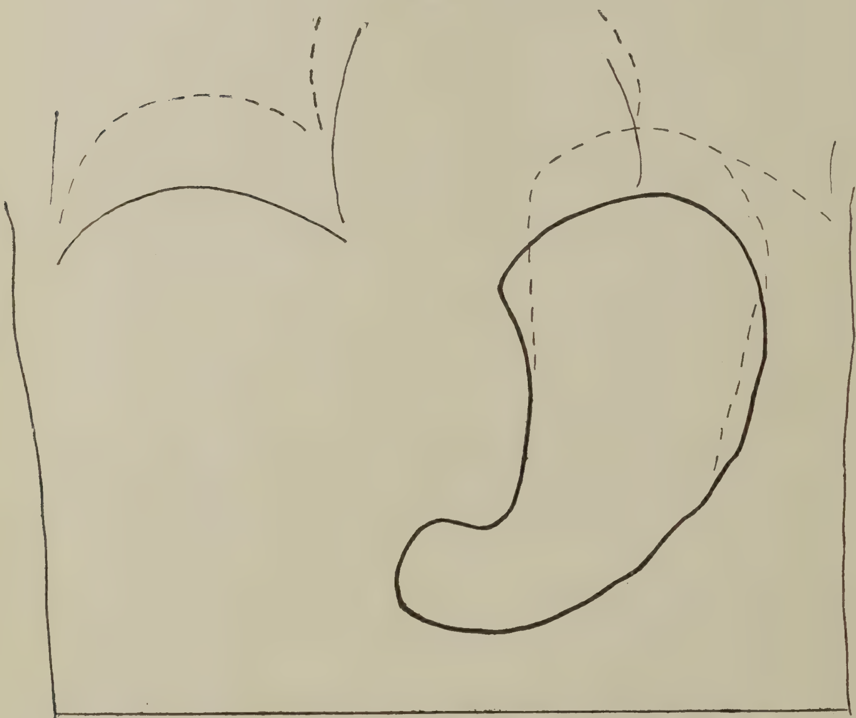
In the abdomen the outline of the spleen, the left kidney and the liver may, under favorable conditions, be seen in the fluoroscope.

The stomach may be examined by giving the patient a large dose of subnitrate of bismuth (which the x-rays do not easily traverse) with food, and then looking at the shadow of its contents by means of the fluoroscope (Fig. 1). I have also taken in this way an x-ray photograph of the stomach contents.

Carcinoma. In all the cases of carcinoma of the stomach that I have examined with the fluoroscope, if the growth could be

seen with this instrument it could be felt. I have taken one x-ray photograph of a carcinoma in the stomach, and its thickest portion, as shown at the operation, corresponded to a dark area shown in the photograph and seen in the fluoroscope.

FIG. 1.



Tracing made by means of the fluoroscope from a girl seven years old, showing the outline of the stomach one hour after a meal of bread and milk containing subnitrate of bismuth. The full horizontal line is at the level of the iliac crests ; the full lines at right angles to it are the outlines of the body ; the other full lines indicate the position of portions of the diaphragm, heart, and stomach during full inspiration. Broken lines show position in expiration. One-half its original size.

Mr. W. B. Cannon, a student in the Harvard Medical School, who has published an excellent article on the movements of the stomach in the cat, as seen by the Röntgen rays, has made, with me, some observations on the size and shape of the stomach in human beings during digestion, which are as yet unpublished.

In *ascites* the surface of the ascitic fluid may be seen in the fluoroscope if the patient is examined lying on his back and

the physician is looking through the body transversely. In the abdominal cavity new growths may sometimes be seen from this same point of view.

Renal or vesical calculi of fair size containing phosphate or oxalate of calcium have been detected by an x-ray photograph. X-ray examinations may be used in other diseases or conditions of the abdomen and pelvis, but I will not discuss them here.

One of their most useful applications is for diseases in or contiguous to the thoracic cavity. I shall consider this subject largely from the stand-point of a practitioner whose special interest is diseases of the chest, for it was the confidence which I had in the possibilities of the fluoroscope to assist in the diagnosis of diseases of the lungs and heart that led me to begin and develop this method of examination.

I think the subject can be most clearly presented by the following cuts (Figs. 2 to 15), that are reduced copies of diagrams which were made by transferring outlines, that I drew on the skin of patients while looking through the fluoroscope, to a skeleton outline copied from one of Luschka's plates. These patients were examined lying down, except the one suffering from pneumohydrothorax.

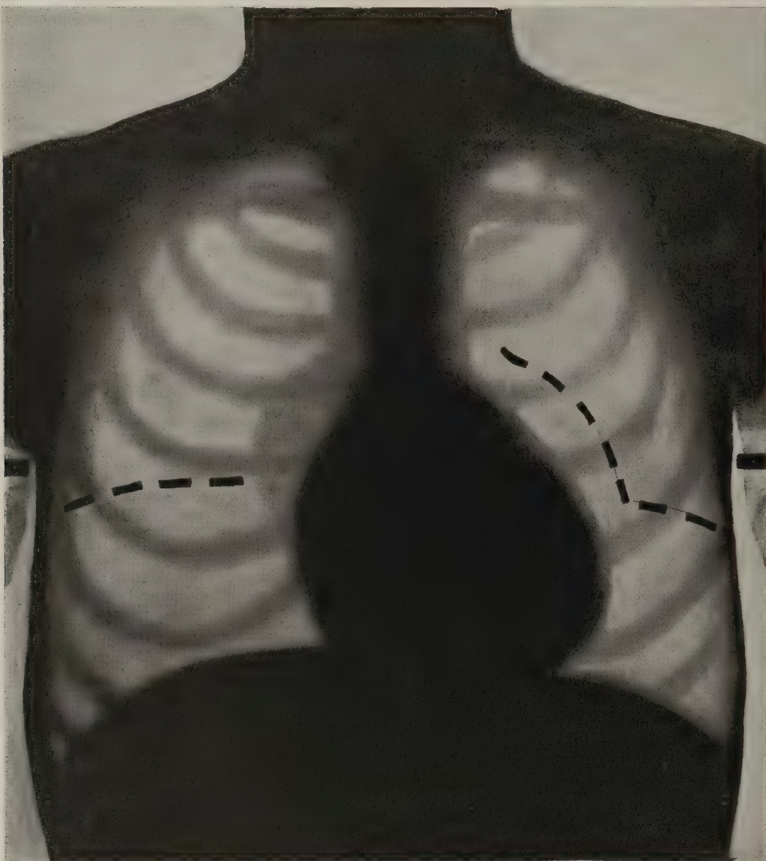
Since it is in part the *movement* of the heart and lungs which we wish to observe, an x-ray photograph does not answer as well as the fluoroscope or fluorescent screen. Examination with this instrument has also the advantage of being made more quickly; the photograph takes time to develop, but gives more details in parts that are at rest.

The positions of the diaphragm and heart are shown as in full inspiration in the diagrams Figs. 2 to 15, and the broken lines indicate the position in expiration. The dark lines at the sides represent the level of the nipples.

In health (Fig. 2) you will see that the diaphragm has a wide excursion between the extremes of respiration, and that the heart also changes its place. In order that you may appreciate what nice distinctions the fluoroscope is capable of making, let me state that the difference in the brightness of the lung-area between expiration and full inspiration may be

perceived in the fluoroscope. In health the lungs are seen to be lighter about full inspiration and darker in expiration, as they then contain more blood per cubic inch. This shows how

Fig. 2.

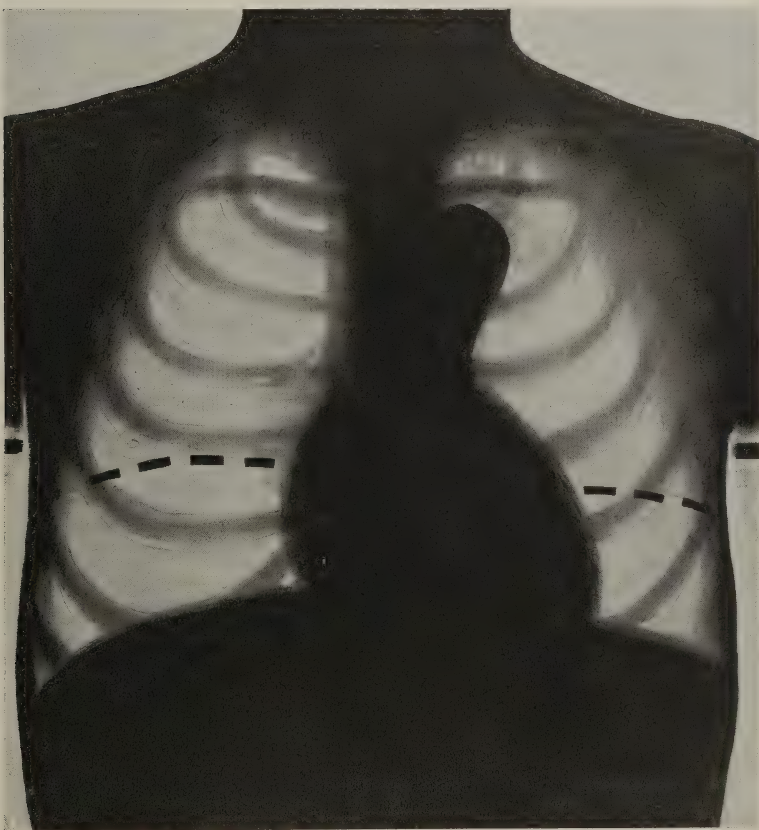


Full Inspiration During Health.

The broken lines show the position of the diaphragm and heart in expiration, but the diagram does not indicate that during this time the light area is narrower. The anode of the Crookes tube in Figs. 2 to 15 inclusive, except in Fig. 12, was placed under the median line, where it is crossed by a line joining the nipples. The tube should be two feet or more away from the patient.

conditions involving congestion, as in early tuberculosis or in some forms of cardiac disease, may alter the appearances in the fluoroscope.

FIG. 3.

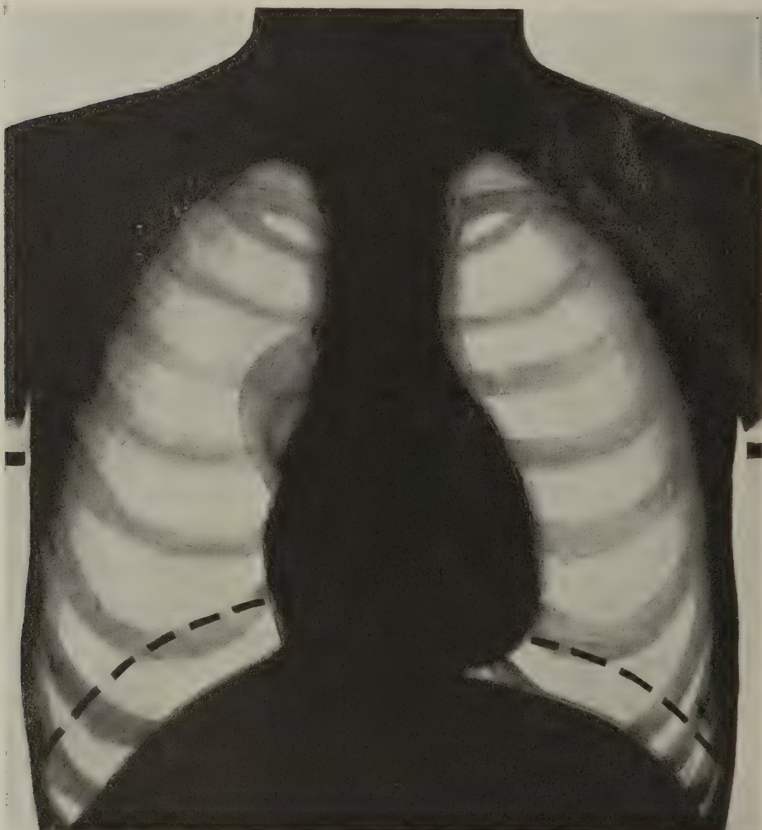


ANEURISM OF THE DESCENDING AORTA.
Broken lines show position of diaphragm in expiration; a dilatation of the ascending portion of the aorta would cast a shadow on the right side of the sternum.

The diagram of health (Fig. 2) is the key to the others, and I shall ask you to use it as a starting-point in studying them. Please compare individually the diagram of each of the diseases

as I take them up with the diagram of health, especially the amplitude of the excursion of the diaphragm and its position in the thorax in certain of them. Usually the excursion of the

FIG. 4.



EMPHYSEMA OF BOTH LUNGS IN FULL INSPIRATION.
Broken lines show position of diaphragm in expiration.

diaphragm on the left side is about two and one-half inches, and generally rather more on the right side; but the excursion

varies with the size of the individual and the shape of the chest. Likewise conditions present in the abdominal cavity may sometimes change the extent and shape of the outline.

FIG. 5.

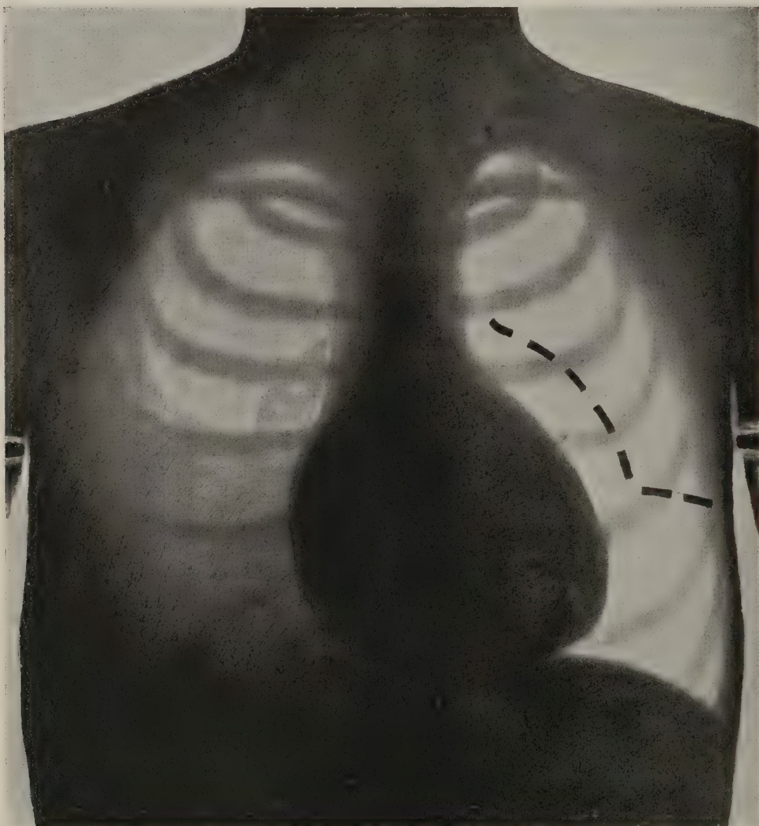
PLEURISY, WITH LARGE EFFUSION.
Broken lines show position in expiration

We will begin with *thoracic aneurism.*

Many thoracic aneurisms (Fig. 3) which were formerly beyond our reach for diagnosis may now be recognized with

certainty, and, further, symptoms due to aneurism are sometimes ascribed to other diseases, and an x-ray examination is required to establish the diagnosis. This diagram represents

Fig. 6.



Pleurisy, with Small Effusion.

the condition found in a patient sent to me in consultation who had a stricture of the œsophagus, and into whose throat an œsophageal bougie had been passed every third day for months.

Another patient, who had a similar aneurism, was thought to have intercostal neuralgia, and had been operated on for this previous to coming to me. In one of my own patients with cardiac disease I was about to give digitalis, but an x-ray examination showed the presence of a thoracic aneurism in an early stage, and I was thus spared from doing him harm. In no other way than by an x-ray examination could these aneurisms have been detected in this early stage.

In emphysema (Fig. 4) you will observe that the excursion of the diaphragm is less than in health, and that it is lower in the chest. The heart is in a more vertical position than in health, and moves less between full inspiration and expiration. In marked cases the right side of the heart, both auricle and ventricle, is larger than normal, and in some cases both sides are enlarged.

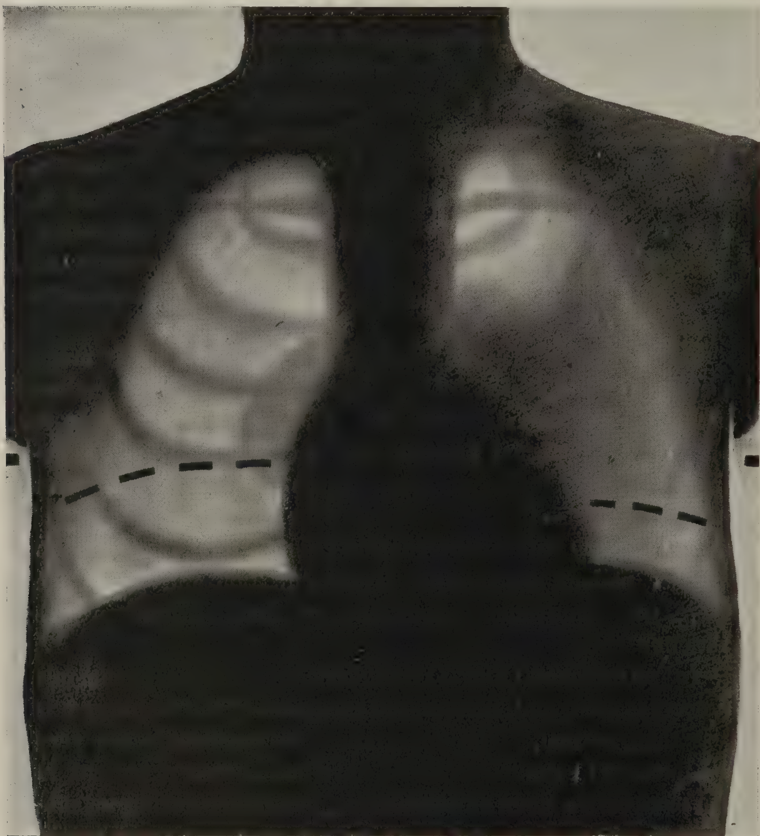
In pleurisy with large effusion (Fig. 5) the heart is much displaced, as indicated by the diagram. I removed a gallon of fluid from this patient's chest. The heart was then seen to be nearer its normal position, and the excursion of the diaphragm on the left side was greater in amplitude and went higher up in the chest—that is, was nearer the normal.

In pleurisy with slight effusion (Fig. 6) the appearances in another patient are shown. By auscultation and percussion there was some doubt about the presence of fluid in this patient's chest.

In pneumonia (Fig. 7) the dark area of the pneumonic process is seen, and, further, the excursion of the diaphragm is less than normal. The appearances in pneumonia are very conspicuous; so much so that I have not chosen a patient in the most active stage of the disease, but rather during its subsidence. This diagram was made from the appearances on the seventeenth day of the disease. No signs were found by auscultation and percussion on this day. This shows that there may be conditions in the chest which are readily seen in the fluoroscope, but which are not patent to auscultation and percussion. On the thirty-second day signs of disease were still seen by the fluoroscope, but the patient was then discharged;

otherwise, an abnormal condition of the lungs might have been followed by means of this instrument for some time longer. In

FIG. 7.



PNEUMONIA. Seventeenth day of disease.

Dark area and restricted movement of the diaphragm on the left side; the movement is also less than normal on the right side. The dark area diminished gradually, and the excursion of the diaphragm on both sides increased from week to week.

cases that I have examined after their discharge from the hospital the lungs attained their normal brightness before the excursion of the diaphragm was normal.

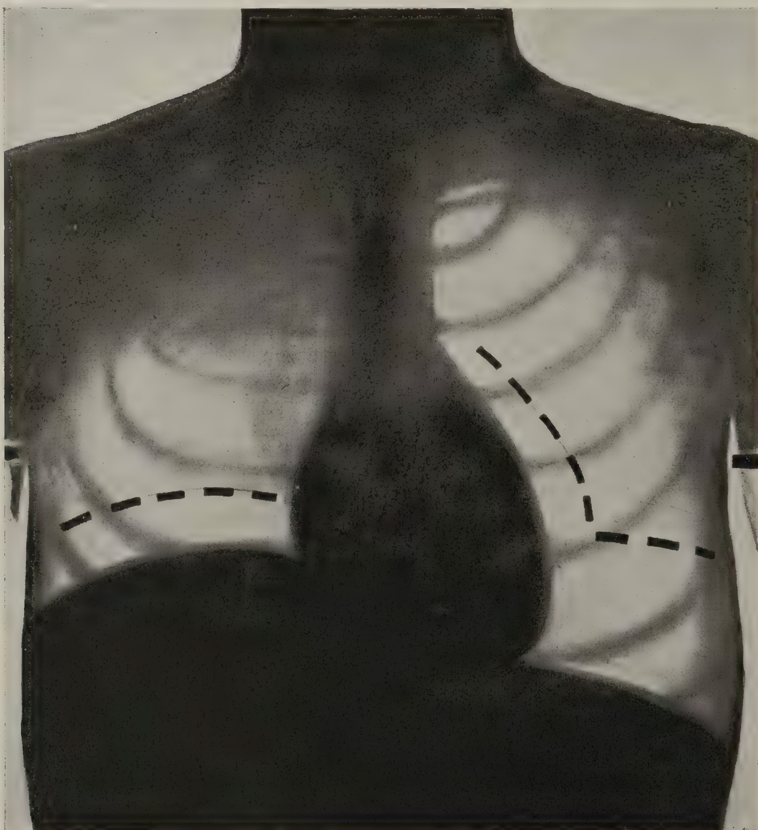
Central Pneumonia. I have recognized the presence of central pneumonia with the fluoroscope before there were any signs by auscultation and percussion.

Pulmonary Tuberculosis. It seems hardly necessary to state that the diagnosis of pulmonary tuberculosis is not made by an x-ray examination alone, but the fluoroscope may show that the lung is in an abnormal condition in two ways: the diseased portion appears darker than in health, and the excursion of the diaphragm in quiet breathing and in full inspiration is restricted, usually on one side in early tuberculosis, and this muscle often goes higher up in the thorax than normal on this side. (The average movement of the diaphragm in the nipple line in health is $2\frac{1}{2}$ to 3 inches in men; it usually goes up higher in the chest, and its excursion is generally greater on the right than on the left side.) These signs lead us to suspect tuberculosis. It is well to make a second examination after an interval of a few days, for both of these signs may sometimes be found temporarily in other conditions, as in anæmia and debility; whether they may then indicate a soil favorable to the development of tubercle bacilli I will not now discuss. Also a diminished excursion of the diaphragm may occur in emphysema; but in this case the muscle goes lower down in the thorax, not higher. Again, we sometimes find a perfectly healthy individual with a chest so unusually deep—that is, with a long antero-posterior diameter—that he has naturally a shorter diaphragmatic excursion than the average.

But when we find by an x-ray examination a shortened excursion of the diaphragm on one side and see that the muscle goes higher up in the chest than normal, accompanied by increase of density of that side, as shown by the diminished brightness of the lung, especially at the apex, we should look for pulmonary tuberculosis. The daily temperature should then be noted and the tuberculin test used. By means of the fluoroscope and the tuberculin test an early diagnosis may be made without waiting for well-defined physical signs, the appearance of cough or the finding of tubercle bacilli; and this is of importance, for delay may deprive the patient of his best

opportunity for recovery. The x-ray examination may give the first warning of tuberculosis, or, if this disease has been already suspected for other reasons, it may add strong supporting

Fig. 8.



Pulmonary Tuberculosis. Right side.

The excursion of the diaphragm is restricted, and restricted to the upper part of its excursion in this disease. In emphysema the movement is restricted to the lower side. In tuberculosis it may be higher in the thorax than in health, in emphysema lower.

In the diagram the apex is darker, and the excursion of the diaphragm is more restricted than in the very early stage of the disease.

evidence. I have taken every opportunity to examine patients with tuberculosis in the early stage, and have usually found the evidences of disease more marked in the fluoroscope than by auscultation and percussion. (When the disease has made some progress the appearances in the fluoroscope are, of course, very conspicuous.)

Further, I have found suggestion of tuberculosis in several patients when auscultation and percussion had not revealed it, whom I examined by the fluoroscope with reference to some other disease. This diagnosis was confirmed by the subsequent development of the case, the presence of bacilli, or by reaction to the tuberculin test.

The dark areas which are found in the lungs in pulmonary tuberculosis are not wholly due, I think, to a consolidation, for a marked congestion may give rise to similar appearances. In some patients, whom I have examined at intervals of a week or two, I have seen these dark areas extend rapidly, and in others diminish in the same way, and as it does not seem probable that other changes in the lung would take place so quickly as the increase and decrease of these dark areas would suggest, a congestion seems to be the natural interpretation of this relatively rapid alteration in the brightness of the lung. Further, in passive congestion or œdema of the lungs in mitral disease the lower portions of these organs may be darker than normal without corresponding physical signs, and, after rest and the administration of digitalis, the lungs soon become clear.[1] Also in patients apparently suffering from debility, and who do not react to tuberculin, we may find a dark area in the lung that clears up after a rest of a week or two. But the recognition of a congestion, especially at the apex, may be valuable in some cases, as an early warning of the beginning of tubercu-

[1] I examined normal lungs, after they were taken from the body, with the fluoroscope, and found they were penetrated by the x-rays with the greatest ease; there was no marked difference in brightness between a fully and a partially distended lung. In life the lungs are brighter during full inspiration than expiration. This greater brightness is due to a diminished amount of blood in an equal volume of lung at this time. These observations, together with others bearing on this subject, are referred to in my article entitled "A Study of the Adaptation of X-rays to Medical Practice," Med. and Surg. Report, Boston City Hospital, January, 1897.

losis, and it should certainly cause us to make a careful investigation with this diagnosis in mind. And in those cases in which our suspicions are excited by a first examination a second should be made to confirm or disprove the first.

In pulmonary tuberculosis the x-ray examination may assist us, first, to make an early diagnosis; second, to estimate the extent of the disease; third, to determine whether it is disseminated or localized; fourth, to recognize a cavity; and in all these cases helps us to decide on the wisest course for the patient to pursue. I wish to emphasize the importance of its first use, for if pulmonary tuberculosis is promptly recognized a considerable proportion of cases can be cured, and cured without change of climate if the patient is able to follow out hygienic treatment intelligently in suitable surroundings. In more advanced cases the knowledge gained by means of an x-ray examination may prevent the patient from being sent on a fruitless and expensive journey in search of health when he should remain at or near his home. I have seen patients who were sent away when a journey was distinctly contraindicated by an x-ray examination, and the result proved the correctness of the indication.

As the x-ray examinations in pulmonary tuberculosis come more into use I am convinced we shall sometimes recognize its presence earlier, and be less apt to overlook the disease in its beginning.

The following cases are chosen to illustrate some of the ways in which x-ray examinations may be useful in pulmonary tuberculosis.

In the first patient the signs in the fluoroscope were more marked than were the physical signs.

Case I.—Lawrence C., twenty-eight years of age, entered the Boston City Hospital, April 14, 1898. Mother died of phthisis; history of several hæmoptyses. On March 31st, coughed up blood several times; says he lost about a pint.

April 14. Physical examination: Harsh respiration over both fronts, otherwise no physical signs.

X-ray examination: Marked darkness over upper two-

thirds of left chest. Excursion of diaphragm one and one-half inches on left side; two inches on right side. The normal excursion, as already stated, is about $2\frac{1}{2}$ to 3 inches, the right side usually moves rather more than the left.

17*th*. Physical examination: Respiratory sounds less pronounced than normal on both sides, otherwise no physical signs.

19*th*. No change in signs by auscultation and percussion. *Second x-ray examination:* Similar to that made on April 14th, but more marked.

The patient was given one-half milligramme of tuberculin, and reacted to it, the temperature rising to 102.4° in eighteen hours.

CASE II.—George S. B., teacher, thirty-two years of age. Lost his mother and one brother by tuberculosis. Hæmoptysis, June 5, 1897. In Dr. Folsom's service in Boston City Hospital for ten days. Nothing found in his chest. Subsequently, to June, had several slight hemorrhages. In July, Dr. Smithwick found a few small râles above the right clavicle.

September 17. Dr. Smithwick found no râles at right apex, but thought he found a few in the right axilla; otherwise, there were no physical signs. Said "the patient might be examined to-day without any signs of tuberculosis being detected;" no rise in temperature; no tubercle bacilli found, though the sputa have been examined several times. Dr. Smithwick brought the patient to see me on September 17th.

17*th*. *X-ray examination:* Right apex to lower border of second rib was darker than the left apex. Excursion of the diaphragm on right side one and three-eighths inches; on left side, two and three-eighths inches. This, together with what had gone before, led me to state that I had little doubt the patient had tuberculosis.

October 3. Dr. Smithwick found tubercle bacilli.

Bacilli had been found in the following patient (Case III.) just before the x-ray examination was made, but it is of interest to compare the signs found in the fluoroscope with those by auscultation and percussion. This patient had been at the

Boston City Hospital, under the careful observation of Drs. Buckingham, Withington, or Jackson for some months.

Case III.—B. C., twenty-nine years of age, male nurse in the Boston City Hospital. Patient in Dr. Withington's service. Admitted May 11, 1898. For past two months the patient has had cough with yellowish expectoration; about one week ago the sputum was streaked with blood. Slight dyspnœa after exertion. The patient thinks he has not lost weight or strength. No chilly sensation; no sweating; appetite fair.

May 11. Physical examination: Heart not enlarged to the right or upward; apex in fifth space in nipple line; action regular; lungs normal, save that breathing is somewhat jerky in places, and fremitus is slightly increased all over right chest. Rest of physical examination was normal.

12*th*. Few râles at inner edge of left scapula; no difference in fremitus or in voice.

14*th*. An occasional indeterminate râle here and there over the chest, not permanent in character; no abnormality in breathing or voice; resonance good.

15*th*. Breathing very little modified qualitatively. Occasionally râles as before, and after cough they are more numerous in right axilla than elsewhere. Tubercle bacilli found in sputum.

16*th*. *X-ray examination:* Whole of the right lung darker than the left, *especially at base.* Excursion of diaphragm on right side seven-eighths of an inch; on left side, two and five-eighths inches.

August 22. Dulness at both apices and moist, bubbling râles; moist râles also present in both axillæ. Right apex, bronchial breathing, with increased resonance and fremitus. Process is diffuse in both lungs, but most marked in the right.

X-ray examination: Right side much darker throughout than the left. Excursion of the diaphragm one-fourth of an inch on the right side and three-fourths of an inch on the left side.

The fluoroscope afforded evidence of tuberculosis in the following case, where the physical signs were not conclusive:

Case IV.—Murdock M., carpenter, twenty-three years of age, an out-patient of the Boston City Hospital, September 17, 1896. History of two hemorrhages: one four years ago and one a year ago. Now complains of pain in the right chest, with slight cough and slight expectoration. Physical examination by Dr. Ames was negative, except for a few "clicks" at the junction of the second rib and the sternum on the right side and at left apex behind.

September 17. The patient was brought to me for an *x-ray examination*, which was as follows: Two-thirds of right lung, beginning at apex, darker than normal, as well as apex of left lung. Excursion of diaphragm shorter and higher up than normal on the right side.

October 3. Physical examination by Dr. Tenney: Slight dulness at *left* apex, back and front, with harsh respiration and increased voice sounds. It was learned at this time that the father and three brothers had died of phthisis.

Two examinations for tubercle bacilli had been made with negative results.

Case V.—H. C., twenty-six years of age, entered the hospital January 24, 1898, in Dr. Shattuck's service. Family history negative. Had not felt well for three weeks; headache, pain in back, anorexia; pain in the stomach for two weeks. Had been in bed three days prior to entrance. Epistaxis four days before entrance. Bowels regular; no cough; pulse, 80; respiration, 20; temperature, 101°. Heart: right border at middle of sternum; left border, three centimetres inside nipple line; apex, two centimetres inside nipple line; sounds normal. Lungs: resonance and respiration good throughout; no chest symptoms whatever. Spleen not felt. Abdomen tympanitic; tenderness more marked on right side. Widal's serum-test was made eight times, always with a negative result. Leucocyte count normal; no arsenic or lead in the urine.

February 12. The patient was in my service from February 1st until his discharge. The finger-ends are markedly clubbed.

X-ray examination: Both sides of the chest darker than nor-

mal; no special area markedly dark, but rather the darkness was uniformly distributed. Excursion of the diaphragm on the right side one and three-fourth inches from the upper border of the fourth rib to the upper border of the fifth rib; on the left side, one and one-fourth inches from the middle of the fourth rib to the upper border of the fifth rib.

25*th*. Patient is losing ground. Has no pain, no cough; appetite is good.

March 3. Resonance: both front and back unusually good; suggests emphysema rather than consolidation; no râles.

4*th*. Still losing weight; no improvement.

X-ray examination: Right side darker than left throughout. Upper two-thirds of left chest so dark that the ribs are barely seen, and only during full inspiration; diaphragm barely seen on inspiration on right side; on left side seen only during inspiration.

7*th*. Resonance over both fronts is increased rather than diminished; respiration normal; expiration not prolonged; resonance and respiration over backs normal.

8*th*. Since admission the temperature has run an irregular course and the patient has grown weaker and thinner. (Four days after entrance the temperature rose to 104.5°, varied for ten days from 99° to 102°, then from 102° to 103° for six days, after which it was very irregular for several weeks, varying from normal to 103°.)

10*th*. Respiration over a small area in right front just below clavicle is harsh; tactile fremitus slightly increased; no râles. Resonance not so good over right base behind as elsewhere, and respiratory sounds are diminished.

11*th*. *X-ray examination:* Right side darker than left during expiration; lung nearly as dark as liver. Only a portion of left border of heart is seen. Diaphragm on right side moves one inch; on left side, one and one-eighth inches.

20*th*. There has been much improvement; patient is now up.

April 4*th*. *X-ray examination:* Both chests clearer than at last x-ray examination; ribs can now be seen on both sides; both borders of heart seen. Diaphragm on right side moves

one and one-fourth inches; on left side, one and one-eighth inches.

19*th*. *X-ray examination:* Outlines of the heart and of all the ribs are seen clearly. Excursion of the diaphragm on right side one and three-eighth inches; left side, one and one-half inches.

Temperature has been between normal and 100° for nine days, and the opportunity was given to try the tuberculin test. One-half milligramme of tuberculin was injected; temperature rose to 102.8° eighteen hours later, and then fell to 99.5°. Malaise; patient complained of feeling sore all over.

To recapitulate: This patient's illness began about January 1, 1895. He was first thought to have typhoid fever, but later this diagnosis was regarded with suspicion. During February he failed very much; had to be fed for about three weeks, was losing in weight and strength, and I gave a very unfavorable prognosis to his relatives. On March 9th the outlook for the patient's recovery was still less hopeful, but on March 20th he was up and dressed. No definite diagnosis was made until February 12th. I then examined him with the fluoroscope, and made the diagnosis of disseminated pulmonary tuberculosis. On April 19th, as already stated in the physical examination, he reacted to the tuberculin test. The patient was discharged from the hospital on April 22d. He had gained in weight and strength, although still rather thin; color good.

June 24, 1898. Has gained three pounds in the past four weeks.

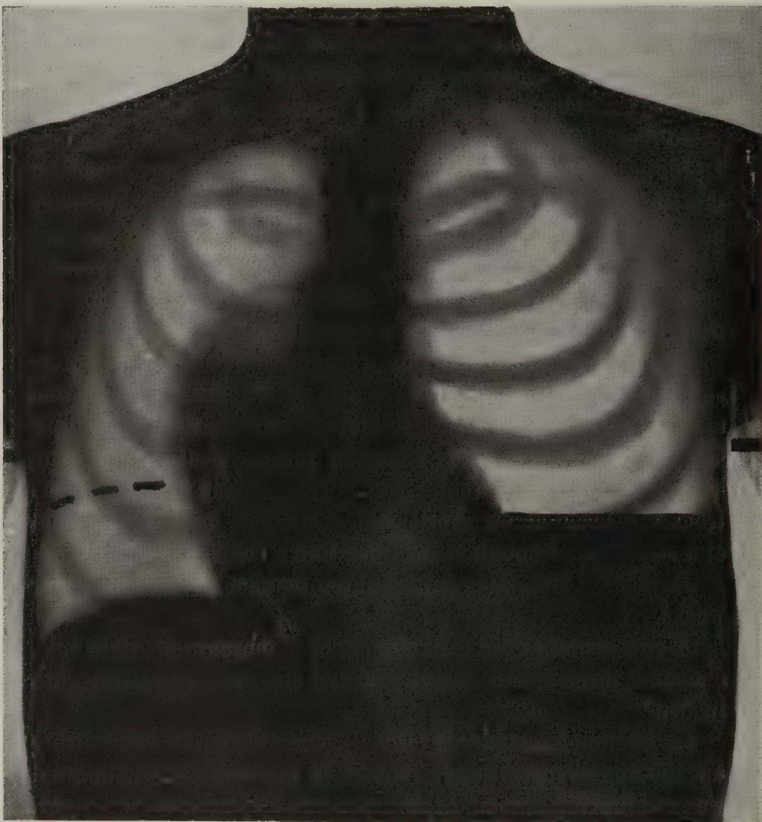
X-ray examination: Excursion of diaphragm on right side, one and three-fourth inches; on left side, one and five-eighth inches.[1]

In pneumohydrothorax (Fig. 9), when the patient was sitting up, the appearances were as shown in the diagram. The fluid was on the left side and the heart was displaced to the right. The level of the fluid changed as the patient bent backward or forward. When he was gently shaken the splashing of the fluid was clearly seen, and while quiet the waves made by the heart-

[1] I have given in Med. and Surg. Report, Boston City Hospital, January, 1897, an outline of thirty cases of pulmonary tuberculosis chosen from more than fifty examined in 1896.

beat were clearly visible on the surface of the fluid. In the summer of 1897 I demonstrated this to Dr. Buckingham, who related what he had seen to other medical men, but they could not be induced to believe it was not a joke.

FIG. 9.

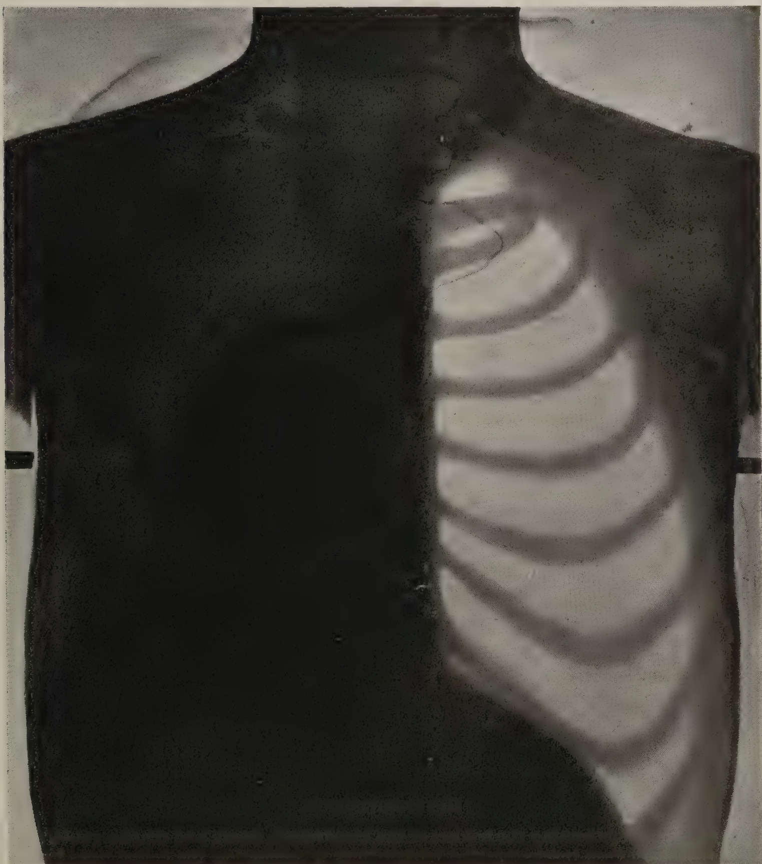


PNEUMOHYDROTHORAX. Left side.

In pneumothorax (Fig. 10) the diaphragm on the affected side is much depressed, and its slight movement during respira-

tion is in the portion near the median line, and is probably imparted by the movement of the right side. The heart is

FIG. 10.

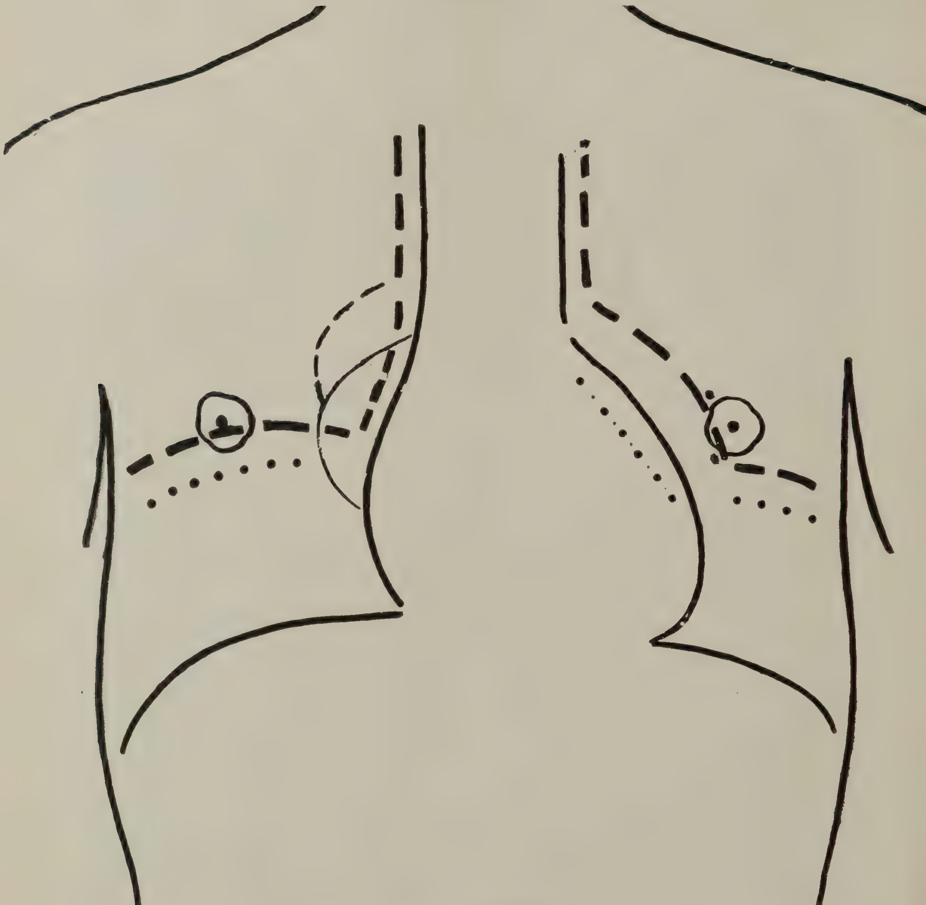


PNEUMOTHORAX ON LEFT SIDE, AND TUBERCULOSIS ON RIGHT SIDE.

pushed to the other side. This patient also had tuberculosis on the right side.

Let us now take up x-ray examinations in disease of the

Fig. 11.



Heart-movements.

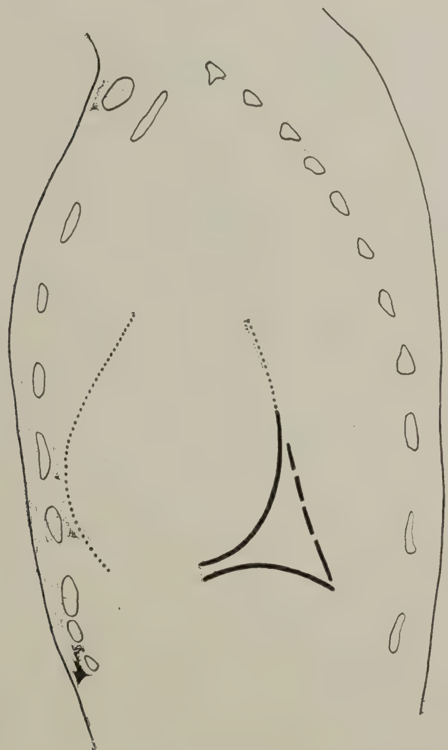
Diagram representing the borders of the bloodvessels, heart, and diaphragm—the full lines in deep inspiration, the broken lines in expiration, the dotted lines just below the broken ones the position of the diaphragm in ordinary inspiration.

The line of large and small dots inside the left border of the heart shows the position of the left border in systole, and the full line in diastole, during full inspiration. The other movements of the heart—namely, those of the apex, the right ventricle, and the right auricle—are not indicated in the diagram.

It is obvious how the fluoroscope may assist to determine the position, size, and mobility of the heart.

heart, and first recall that the normal heart is a very movable organ; that it varies in size and position within certain limits; that it is readily pushed out of place, and that the direction of

FIG. 12.



TRIANGLE.

The outline of the body and the ends of the ribs have been traced from an anatomical plate, which represented a section of the body through the left parasternal line. The heart-lines and the outlines of a portion of the diaphragm and spine, or rather what lies in front of the spine form the triangle, and were drawn while looking through the fluoroscope on the left side of a patient during full inspiration and then sketched—in about the proper position—on the drawing from which this diagram was made. This triangle is usually closed at the anterior angle, although it did not happen to be in this patient.

It will be seen that the outline of the heart is indicated partly by a full and partly by a dotted line. The full line shows the extent of the border usually seen in the fluoroscope in health; the dotted line the additional amount seen in this special individual in health.

its long axis is not always the same. In some persons the axis is more inclined; in others more vertical.

The diagram of the heart-movements (Fig. 11) shows what is seen in the fluoroscope when placed on the front of the chest. The heart is seen to change its position during deep inspiration, being moved downward and inward.

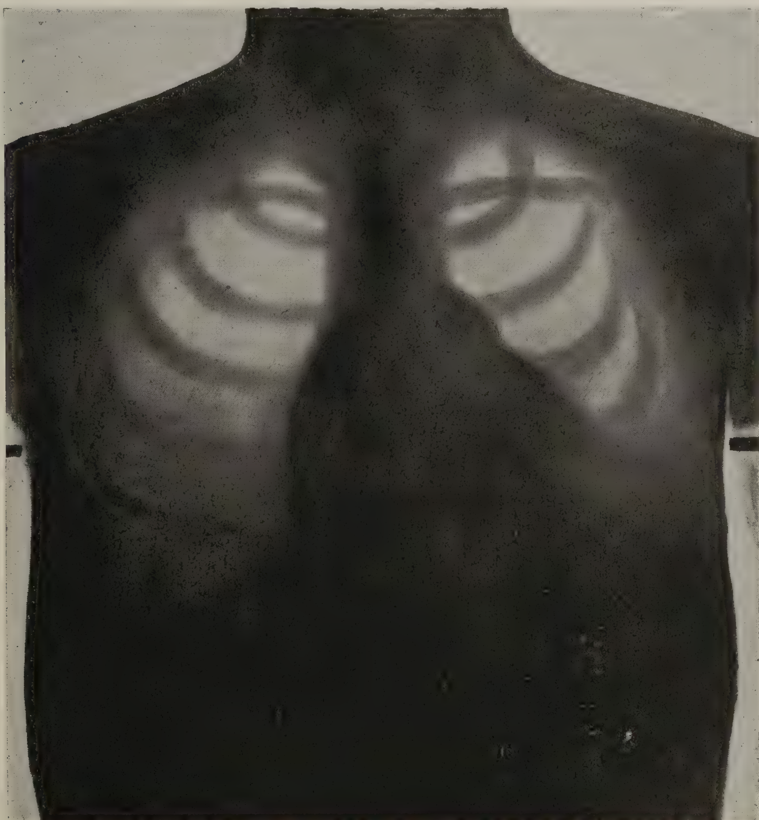
Triangle. While looking through the body from *side to side* during a deep inspiration, a light triangular area (Fig. 12) comes into view, the sides of which are formed respectively by a part of the heart line, of the diaphragm line, and of the spine, or rather what lies anterior to the spine. The last line is less defined than the two others. The triangle varies very much in size and in shape in different individuals, and also varies according to the side on which the observer stands. It is smaller when seen through the fluoroscope on the left side than on the right side. In a patient with a transposed heart this condition was reversed, the triangle being smaller when seen from the right than from the left side. This was due to the fact that the transposed heart was nearer the right thoracic wall than the normal heart, and it is obvious that the nearer the heart to the side of the body where the observer stands with the fluoroscope the smaller will the triangle appear. This triangle should always be seen in health; if not seen, the physician should investigate the cause of its absence.

Let us now return to the usual direction for examining the heart. *The position of the heart* is seen to be changed in diseases affecting the lungs, pleura, or bloodvessels, or by conditions in the abdominal cavity pressing the diaphragm up. A change in cardiac outline, the result of an upward displacement of the heart may be attributed by auscultation and percussion to an alteration in the size of the heart, whereas by the x-ray examination it could be rightly interpreted.

A lessened movement of the heart in deep inspiration may be seen to occur in emphysema, or where the pleura or pericardium is adherent. In one patient I saw the apex tilted up during deep inspiration instead of moving down. This was due, I suppose, to adhesions. We may thus follow some of the

effects on the heart of changed conditions in its vicinity. Some diminished or abnormal movements of the heart during a deep inspiration may be evidence of adhesions.

FIG. 13.



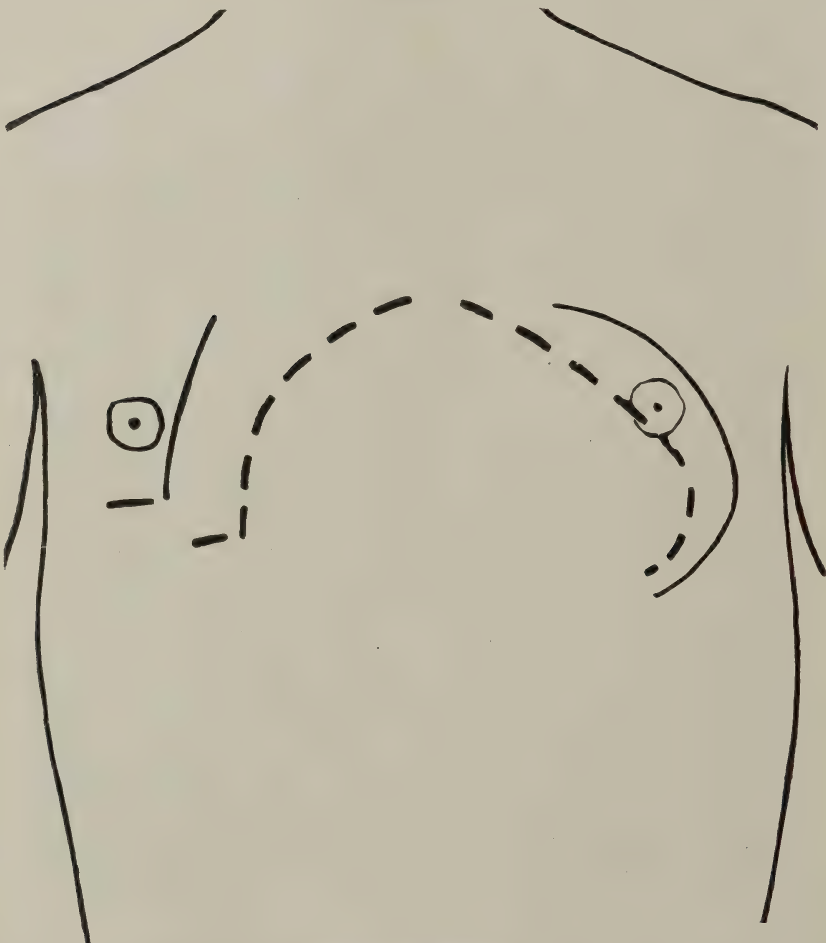
PASSIVE CONGESTION, OR ŒDEMA, OF THE LUNGS.

In valvular disease I have seen much darker lungs than the diagram indicates become clear, and the dyspnœa cease after treatment by digitalis.

Let us consider now some of the changes which affect more nearly the heart itself.

Warning may be given by a passive congestion or œdema of the lungs of a serious condition of the heart or kidneys, as

Fig. 14.



Pericardial Effusion.
Broken lines show outline by percussion, full line by fluoroscope.

shown in the diagram (Fig. 13), though it may be more marked than is here indicated. The lower portions of the lungs are

dark, the outlines of the diaphragm cannot be seen, and only a portion of those of the heart. By such appearances as these I was led to warn one of my patients who had renal disease to put his affairs in order; he died suddenly within three months. By auscultation and percussion I had not appreciated the serious condition of his lungs.

In pericardial effusion (Fig. 14) the outlines of the heart may be obliterated, and, instead of the usual pulsating heart, we see a much larger dark area. The size, shape, and position of the pericardial effusion, and the fact that the outline of the pulsating heart cannot be seen, assist in making the diagnosis. New growths about the heart may sometimes be seen.

An enlarged heart, as in arteriosclerosis or valvular disease, may be recognized in the fluoroscope, and also a heart *smaller* than normal, with which anæmia is sometimes associated, may be readily seen in the fluoroscope. It is, I believe, important for the physician to be aware of the existence of a small heart in any of his patients, both as a guide to the mode of life to be pursued when the patient is in health, and as a factor in prognosis in some diseases, pulmonary tuberculosis for example.

A transposed heart (no diagram of this is shown) may easily be seen in the fluoroscope. During my recent service at the Boston City Hospital my senior house physician asked me to explain to him the conditions present in the heart of a patient who had been admitted the day before. I examined the patient, but withheld my opinion until I made an x-ray examination, as the heart-sounds and murmurs were unlike any I had ever heard in that place. On examination with the fluoroscope I found the patient's heart was transposed, the left ventricle could be seen beating to the right of the sternum, and the right auricle was on the left of the sternum. When the patient was turned around and the fluoroscope was placed on her back, the transposed position of the heart was also very evident. This patient was examined by five physicians previous to the x-ray examination, and we all failed to recognize the transposition of the heart.

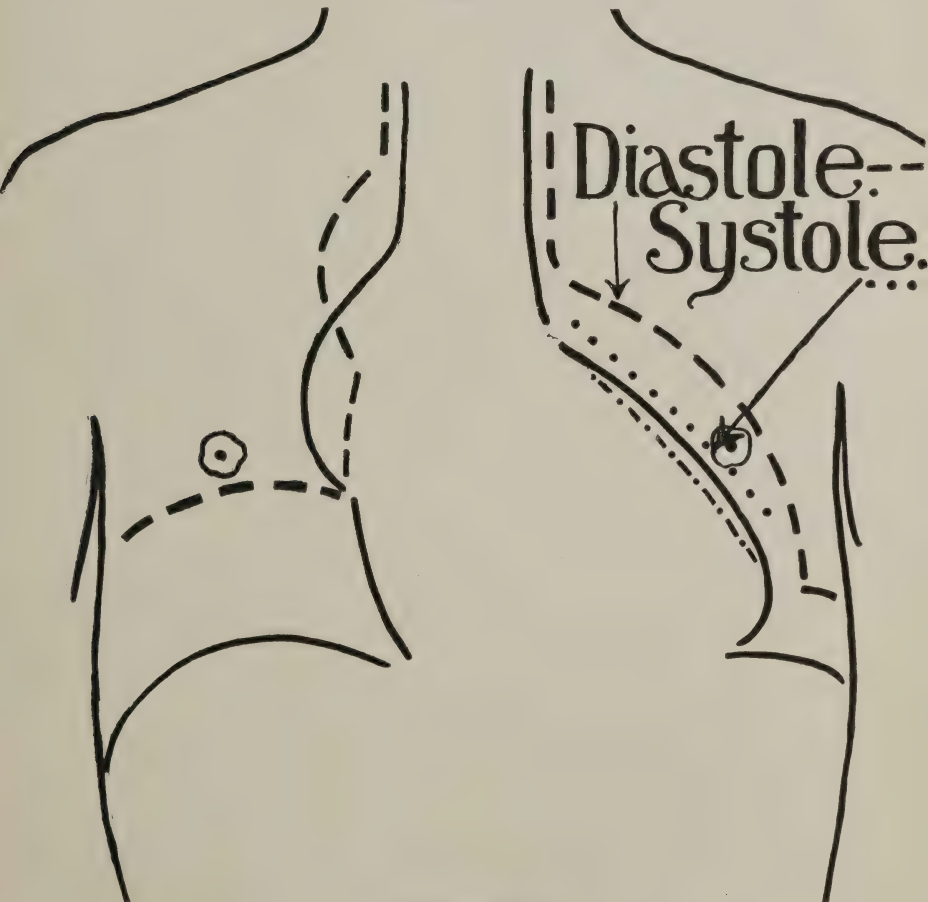
To arrive at a knowledge of the heart's condition in disease

it is of importance to know its size as nearly as possible, and this can obviously be satisfactorily accomplished by means of the fluoroscope, except where pathological conditions partly obliterate the cardiac outlines, as in pleurisy with effusion or œdema of the lungs for instance. Of course, in very stout patients or those with pulmonary emphysema it is often impossible to determine the size of the heart by percussion, but stoutness is no serious obstacle to an x-ray examination, and emphysema is a positive advantage. In fifty-eight patients who were not stout and had no emphysema—that is to say, in whom the conditions were not unfavorable for the use of percussion—I compared the size of the heart as obtained by percussion with that obtained by an x-ray examination. The percussion lines were drawn on the skin in blue and the other lines in black. The outlines drawn by the aid of the fluoroscope were, of course, more complete than those obtained by percussion. The percussion lines varied considerably in a portion of the cases, in some patients an inch or more, from the size of the heart as seen in the fluoroscope; sometimes they indicated a smaller but usually a larger heart than the reality. Twenty-two of the fifty-eight patients had organic disease of the heart, and a more frequent disagreement in regard to one or both borders of this organ, as obtained by percussion on the one hand and an x-ray examination on the other, was found among them than in the remaining thirty-six cases, who were suffering from other than cardiac diseases. I am therefore satisfied that in some—particularly in cardiac cases—we have not determined with exactness the size of the heart by percussion, and, unfortunately, we cannot tell in which of our patients percussion will fail in accuracy. It is well, therefore, that we should realize this in those cases in which we desire precise information about the size of the heart.

Let us compare these two diagrams—namely, *Heart-movements* (Fig. 11) and *Aortic Insufficiency* (Fig. 15)—the first of which was made from a healthy individual and the other from a patient who was unconscious of any cardiac disease, but who had a marked insufficiency of the aortic valve. It is ob-

vious that the left side of the heart in the patient with disease of the aortic valve is much larger than normal. I could see

Fig. 15.



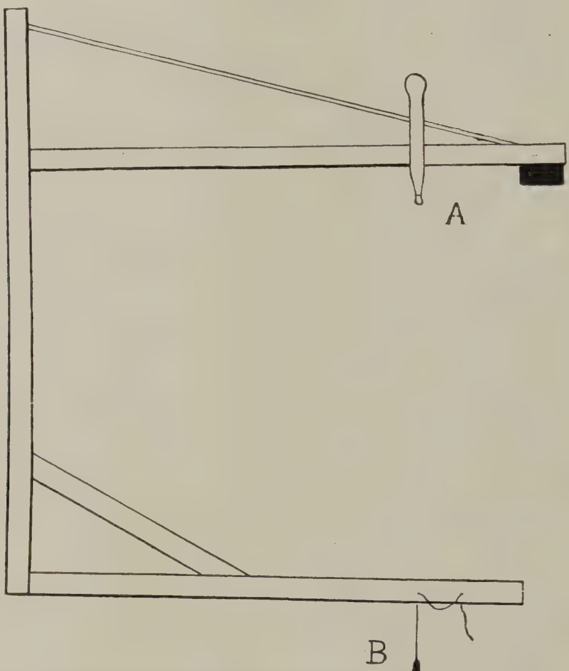
Aortic Insufficiency.

Diagram of heart in a patient with aortic insufficiency. Compare with Fig. 11.

Diastole and systole during *ordinary* respiration are indicated by the arrows and the broken and the dotted lines respectively. The line made up of dashes and dots shows where the left border of the heart is in systole during deep inspiration. When a full breath is taken the heart is compressed, and the diastolic excursion is less than in ordinary breathing. The movements of the heart could be followed in this patient unusually well.

the great left ventricle making a large excursion between systole and diastole, and appreciate better than ever before what an extraordinary quantity of blood is delivered into the aorta

FIG. 16.



INDIRECT PLUMB-LINE. Scale one-eighth of an inch to one inch.

An instrument, which is a form of plumb line, to be used when the patient is lying on the stretcher, that I have devised for determining the exact position of the Crookes tube when it is desired to place it directly under the point to be examined. This instrument is especially useful in cases where the median line is not available as a point of reference. I have used it from time to time for more than a year. By it the right and left borders of a large heart may be determined separately.

This instrument is made of strips of cedar one-eighth inch thick and one inch wide. There is a counterpoise of lead on the end of the arm beyond A. The vertical piece from which the arms A and B extend is made of two strips of cedar, fastened at either end and separated three-quarters of an inch in the middle by a piece of cork. This is done to give stiffness.

A piece of thin wood about two inches square with a depression in the centre (not shown in the figure) is placed on the patient so that the depression is over the point to be examined, directly under which it is desired to bring the Crookes tube. The rounded point, A, is placed in the depression, and the rest of the instrument being free to swing, the weight, B will hang directly under A; the position for the anode of the tube is just under B.

with each systole in order to make up for the large amount which was sure to leak back during each diastole. Further, it could be distinctly seen that the excursion of the left side of the ventricle was diminished when a full breath was held, as then the heart was compressed by the lung. I refer to this patient in order to indicate to you that it is now possible to examine more completely than hitherto patients who have or are feared to have cardiac disease.

To carry out this new method of examination properly requires large and expensive apparatus and experience in using it with a considerable number of patients. The x-rays do not burn, and there need be no fear of injury from the accompanying electrical discharge to any individual if the examinations are properly conducted and simple precautions are taken. At the Boston City Hospital I have made about two thousand x-ray examinations, and no one has received any injury or even inconvenience from them. It is easy to burn the fingers if they are put too near a candle, but it is not therefore dangerous to read by its light.

This new method of examining our patients has now passed the stage of mere interest and novelty, and in its own special field, if suitable apparatus is used, can be counted among our trustworthy aids to diagnosis. In some cases it gives us more accurate information, and in certain others information that we have hitherto been unable to obtain.

I desire to record my appreciation of the value of Dr. William H. Rollins' investigations, published in the *Electrical Review*, which have promoted the usefulness of the Röntgen light in medicine and in surgery, and to express my gratitude to him for his untiring readiness to aid me to overcome the obstacles which have beset those who are using x-ray apparatus.

DISCUSSION.

Dr. F. I. Knight: I would say that Dr. Williams, before the meeting, told me that he hoped there would be a very free discussion of his paper. I do not consider myself able to discuss it, but announce Dr. Williams' desire to those gentlemen who are. He wants, if possible, criticism, for it is a new field, and he would welcome it.

For my own part, I feel with him that the fluoroscope is a very important addition to our armamentarium. In a case of suspected aneurism, I appreciate its possible great value when I recall the number of cases I have seen in which there has been doubt as to what was compressing the trachea. If we could get such a picture as this on the wall there would be no question but that it was an aneurism; and so in regard to the size of the heart. I was particularly impressed with what Dr. Williams said about emphysema being an aid rather than a hinderance, as emphysema interferes so seriously with the results of percussion, and he also tells us that excessive fatty condition of the chest-walls, which renders percussion in the cardiac region difficult, is very little hinderance to examination with the fluoroscope. And even in tuberculosis, notwithstanding the criticism of my learned brother yesterday, I do think that every aid we can get to an early diagnosis is going to be of much importance. As yet it seems, perhaps, that it is of less advantage in that disease than in others. It is evident, from what I have seen and from what Dr. Williams himself admits, that this art is difficult, and for a time, perhaps, it must rest in the hands of those who have had long experience, like Dr. Williams; but in the end perhaps methods may be simplified so that we can all avail ourselves of it. At any rate, in doubtful cases we can have the aid of our brothers who become expert in it as Dr. Williams has.

Dr. Quimby: Will Dr. Williams tell us just his rule for placing the x-ray tube behind the patient as regards a definite distance from and its relations to the spinous processes? I would also ask if he has found any fluoroscopic screen which can be made to conform to the chest-wall. It would seem that absolute uniformity in placing the tube, both as to distance from and relation to the spine, would be imperative to avoid relative distortion of the outlines of the heart upon the screen. I understood the doctor to say he had not seen the heart shorten. It was my good fortune recently, through the courtesy of Mr. Tesla, to see a most perfect demonstration of the heart. When the tube was more nearly in the plane of the spine the lateral excursion of the heart was prominent, but when carried more to the left and lower, then the shortening was equally prominent and distinct.

Dr. J. E. Stubbert: I did not have the pleasure of hearing the first part of Dr. Williams' paper, but I believe he wrote the most scholarly article, about a year ago, that ever appeared on the subject, and I am thoroughly familiar with his views. It is hardly necessary to add anything to what he has said, but with reference to a remark of Dr. Quimby's as to the shortening of the heart, I wish to state that I have observed it a number of times. When I first began working in this line it was my custom to bring into the dark-room laymen who would naturally have no knowledge of what they were to see, and they have often described to me the shortening of the heart in action; I have repeatedly noticed a dimpling of the apex.

The doctor referred to some one considering the examination by x-rays a joke; I have gone through the same experience. I remember Dr. H. P. Loomis once came to Liberty and told me he did not believe in the x-rays at all. I brought in a case which neither of us nor my house physician had seen before. I asked Dr. Loomis to examine the case, and he diagnosed it as consolidation of the right apex, with beginning of softening and some infiltration in the lower lobe. He made the rather significant remark that he might not have a cavity, but was beginning to excavate. I then examined the patient and agreed with Dr. Loomis' diagnosis. I sent for the house-doctor, and he made an x-ray examination; after a moment he said, "This man has consolidation of the right apex, he has infiltration of the lower portion of the lung, and while he may not as yet have a cavity, he is going to have one in a short time." Dr. Loomis said: "Well, if it can be diagnosed in that way I will have nothing more to say," and he is now a convert. There is no doubt in my mind that we can diagnose, especially in thin subjects, very slight infiltrations at the apices of the lungs. We all know how difficult it is to educate our ears sufficiently to distinguish indistinct sounds, but with the x-ray the very slightest infiltration is shown in the form of a slight haze.

Four brothers were brought to me, one with laryngeal tuberculosis and infiltration of the apices. There was a bad family history; the examination of the remaining three by the ordinary methods revealed nothing, but with the fluoroscope I was able to distinguish a very slight haze at the top of one lung in two of them. The result was that those boys were left in the country for a winter, and when I examined them some twelve months later the haziness had disappeared, and they were apparently saved from a more serious form of tuberculosis by the examination with the x-rays.

The question of burns is a very interesting one to me, as early in my experiments two patients were rather severely injured. At first I used a coil, and the accident happened in attempting to photograph lesions of the lungs. One of the patients recovered in a very short time, and the other one died from his pulmonary disease before the

skin lesion had healed. We now use the static machine, from which I have never seen bad results.

Another form of tuberculosis that I think is more easily demonstrated by the fluoroscope than by ordinary methods of examination is the disseminated one. The condition of pericarditis with effusion is one that I have never seen. Pleurisy with effusion is very easily marked out.

One more point regarding the remarks of Dr. Butler last night as to the shape of the right side of the heart. I would like to ask Dr. Williams what his experience in that line has been. It never having been brought to my mind, I have not studied the exact outline of the right side of the heart, but, speaking from memory, I remember only three or four cases in which the outline was vertical, as stated by the doctor last night. In most cases the right side of the heart shoots off rather abruptly above the margin of the fifth rib, and I should be inclined to think that the shadow thrown can be more depended upon than the percussion note.

Dr. R. G. Curtin: It occurred to me, when Dr. Williams told us that in one case where the lung was a little cloudy the use of digitalis cleared it up, that the patient might have had œdema of the lung which was cleared up by the treatment. I would like to ask Dr. Williams what the appearance is of old pleural effusions, especially those in which the pleura was thickened. It has occurred to me that it would be difficult to distinguish between the catarrhal process and that of tubercular infiltration, that is, if the sputum on examination yielded no bacilli.

Dr. Vincent Y. Bowditch: It is hardly necessary for me to speak on this paper; it is, however, my pleasure and privilege to testify to Dr. Williams' painstaking, careful work in the City Hospital, where I have been associated with him. One point comes to my mind, and that is the apparent ease of recognition of incipient tuberculosis by means of the x-ray machine. It seems hard to realize, knowing the translucency of most tissues, that by the x-ray machines we can discover a very slight beginning tuberculosis when we cannot discover it by auscultation and percussion. I should like to have Dr. Williams enlarge a little more on that subject.

Dr. Williams: I did not take up the methods of examination in this paper because I had described them in previous articles.[1] My patients at the hospital were brought into the x-ray-room on a stretcher, which fits on to supports attached to the stand of the x-ray machine. If a patient is too ill to be moved he cannot very easily

[1] "A Study of the Adaptation of the X-rays to Medical Practice." Medical and Surgical Report of the Boston City Hospital, January, 1898. "X-rays in Medicine." Medical News, May 14, 1898.

be examined, although this is possible by means of a portable x-ray machine. The anode of the Crookes tube should be, at least, two feet away from the patient for examining the thorax, and usually under the point where the median line is crossed by a line joining the nipples; this position should be determined by plumb-lines. The median line is obtained by sighting from a permanent plumb-line, that is fastened to the middle of the support upon which the head of the stretcher is placed, to another fastened to the support at the foot in the same way. The other line is determined by putting a string seven or eight feet long, with a weight on either end, across the chest from nipple to nipple; that is to say, on a level with the fourth ribs. The line hangs down on either side of the patient, and the point is obtained by sighting, as before, from weight to weight, and the anode may then be brought into line with these weights. The patient should be lying on his back when he is examined if the plumb-lines are used, but can be turned afterward if desired. In this reclining position the patient is perfectly comfortable and his strength is not taxed. I tested the correctness of the plumb-lines as a guide to the position of the tube by making two successive examinations, the patient getting up and the tube being moved after the first examination, and both patient and tube being rearranged for the second. The outlines of the heart and ribs, traced by means of the fluoroscope in these two examinations, differed only by the width of the line. (See Fig. 16.)

The essential part of the fluoroscope is the screen, and if the room is properly darkened this may be used alone, as the box part of the fluoroscope, which excludes the ordinary light from the eyes, is not then necessary and prevents them from being brought as near to the screen as is sometimes desirable. This screen should be twelve by fourteen inches, and for making a permanent record of a case may be covered to advantage with a piece of thin glass or a film of celluloid or gelatine—these do not obstruct the light. If the surface of the film is ground an ordinary pencil may be used, but for smooth surfaces a lithographer's pencil is necessary. The outlines of the heart and diaphragm, for instance, that have been drawn on the film, may be traced, after the patient has been taken away, on a suitable sheet of paper placed over the film if both are held up against a window. The patient's name, the diagnosis, date, etc., may be added and the paper filed away for future reference. Some of the examinations[1] I have made were recorded in this way, but more by using tracing-cloth that was placed directly on the patient, and the lines

[1] I have now tracings and notes of more than one thousand x-ray examinations which are classified according to diseases, but thus far I have not had the opportunity of publishing as many of the results as I shall hope to later.

which had been drawn on the skin[1] by means of the fluoroscope were traced upon the cloth.

For purposes of study the best machine is necessary; but, having learned to identify the appearances in the chest, for instance, under both normal and abnormal conditions, a portable x-ray machine may be used with satisfactory results if the patient is too ill to come to the office or, in case of a hospital patient, to be moved to the x-ray room, but if the physician is not familiar with these appearances a small machine of this kind is unsatisfactory.

I have not discussed the heart's pulsations fully, but I did not mean to suggest that the heart appears to have no motion at the apex, but merely that its most conspicuous motion is on the left side, as shown in the diagram. To show the apex of the heart another position of the tube is better than the one chosen for these diagrams.

The normal heart varies in size and position within certain limits. I have already referred to the great importance of determining whether or not the heart is smaller than normal. We also need to know if the heart is of unusual size, and, if this is the case, in what part the organ is enlarged. The right border of the heart is difficult to determine by auscultation and percussion, but it is seen in the fluoroscope, during full inspiration, about one inch and three-quarters to the right of the median line. In women and boys and girls the distance is less.

We can see the right auricle in both health and disease, and in certain diseases a part of the left auricle also.

Aneurism of the heart may be seen in the fluoroscope; also aneurism of the aorta. The outlines of an aneurism of the aorta, which appears on the screen as a dark area, may sometimes be seen to move with the pulsations of the heart, but when these pulsations are not seen the diagnosis with the fluoroscope must be based on the position and shape of the dark area.

Let me refer for a moment to the diagram of pericardial effusion taken from a patient in my service in the early part of 1897.[2] I examined him with the fluoroscope because of this effusion, but while doing so observed that the apex of the right lung was darker than normal. I then made a physical examination of the lungs, but could find no evidence of phthisis. I continued to examine the lungs in the fluoroscope from time to time, and noticed that the diseased area extended and the excursion of the diaphragm on the right side diminished; finally the left lung also became involved, and the movement of the diaphragm on this side was also shortened. No physical

[1] It is not necessary in most cases to remove the clothes.

[2] I reported this case in an article entitled "The Röntgen Rays in Thoracic Diseases." American Journal of the Medical Sciences, December, 1897.

signs were found on the left side at this time by auscultation and percussion, but they were now marked on the right side. I gave the patient tuberculin, to which he reacted. The excursion of the diaphragm is sometimes seen in the fluoroscope to be restricted before a diminution in the brightness of the lungs is observed.

Among the cases of pleurisy with effusion that I examined with the fluoroscope there were some in which a darkened area of the lung and a diminished excursion of the diaphragm led me to suspect tuberculosis when it had not been detected by physical examination. This suspicion was afterward confirmed in certain cases by the tuberculin test, or by the finding of bacilli, or the development of the case.

Œdema of the lungs may be distinguished from early tuberculosis by means of the fluoroscope. In the former the lower part of the chest on both sides is dark, whereas in early tuberculosis the darkness is usually on one side and at the apex.

Adhesions of the pleura without thickening would not obstruct the passage of the rays and, therefore, could not be seen in the fluoroscope, but, if the movement of the diaphragm were restricted, an adhesion might be suspected.

Auscultation and percussion may leave us uncertain whether we have to deal with an adhesion with thickening, or with a pleuritic effusion; but the fluoroscope can tell us certainly if fluid is absent, unless it is encysted. If present the diaphragm line is obliterated on the side of the effusion, especially in the outer portion where this muscle curves down to the side of the chest, because fluid would sink and fill-in this lower and outer angle unless it were encysted. The ability, then, to follow this portion of the diaphragm line proves the absence of fluid, except in the particular case just mentioned. Even in such a case I have suspected the presence of fluid by means of the fluoroscope, and this suspicion was confirmed in one case by an autopsy and in another by tapping. The x-rays enable us to choose the most desirable place for inserting the needle. Calcareous deposits in the pleura are seen as dark areas in the fluoroscope. This is also true of some calcareous deposits in the aorta or in certain portions of the heart.

A suitable outfit for making x-ray examinations will cost at least $500. I have been obliged to have mine made to order, and thus had the opportunity to devise the various adjustments necessary for a practitioner.

Burns may be produced when either the static machine or the coil is used, but with the simple precautions now known to the practitioner they are wholly avoidable. None of my patients have ever been burned, and I have been making x-ray examinations, sometimes with the static machine and sometimes with the coil, during about two and one-half years. Tesla suggested placing a screen of aluminum wire or a thin sheet of aluminum, which should be grounded, between the tube and

the patient to prevent any risk of burns. The following experiments of an electrical engineer, made upon himself with a static machine, suggest that burns may be prevented by grounding the anode. During the first fourteen days of November, 1896, he exposed his skin to the Crookes tube at a distance of less than two inches. The first exposure was three-quarters of an hour; the second, half an hour; the third, one hour; and the fourth and fifth, half an hour each. These successive exposures were at intervals of about three days. The anode was always grounded, and there were no untoward results. On December 21st he exposed the same portion of his skin in a similar manner for half an hour, without grounding the anode. Twelve days later the skin was blistered, and a severe ulceration followed.

Photography gives more detail than the fluoroscope; for instance, I have taken x-ray photographs which showed normal arteries; these could not be readily seen in the fluoroscope; but the latter has the advantage in examining the thorax, for example, as the movements of the diaphragm and heart can be watched, and the examination with this instrument can be made more quickly. Photography requires a great deal of time, even with the dark room at hand, as it is necessary to wait for the plate to be developed; but I use either the fluoroscope or the x-ray photograph as occasion requires.

I do not know exactly how many hospitals have x-ray machines; I am told that at least thirteen in New York have them. We have them in Boston, and they are also to be found in Philadelphia, Baltimore, Chicago, St. Louis, San Francisco, and, probably, in all the large cities in the country.

One last word about this method of examination. In hospitals it will be always desirable to have a photographer to take the x-ray photographs, to keep everything in order, and manage the apparatus; but it is not practicable for other than medical men, trained in this special work, to make the x-ray examinations with the fluoroscope. You would not send a patient to a man who was not a physician for auscultation and percussion.

THE INHALATION OF OXYGEN IN ACUTE AFFECTIONS OF THE LUNGS.

By ANDREW H. SMITH, M.D.,
NEW YORK.

Inhalations of oxygen are now very commonly resorted to in chest affections when the dyspnœa becomes marked. The use of this agent was introduced into this country by the writer in 1860. By experiments on animals he had demonstrated that by enriching the atmosphere with additional oxygen life could be maintained for long periods under conditions of tracheal obstruction that would be immediately fatal in common air.[1]

In an essay published in 1870 he showed, what was then generally disbelieved, that the inhalation of even pure oxygen was harmless,[2] and urged the addition of the gas to the inspired air in a variety of diseases in which it had been found useful by European practitioners.

The introduction of compressed oxygen in cylinders for commercial purposes facilitated the use of the gas in sufficiently liberal quantities to test its real value as a therapeutic agent, and for the last twenty-five years it has occupied a prominent place in the treatment of respiratory affections, and especially pneumonia.

The result of the use of oxygen in cases of respiratory diffi-

[1] Oxygen Gas as a Remedy in Disease. Prize Essay of the Alumni Association, College of Physicians and Surgeons, New York.

[2] Among other experiments, a number of mice were confined under a bell-glass, into which flowed a constant stream of pure oxygen. In this way the products of respiration were removed as rapidly as formed, and the purity of the respired gas was maintained. The experiment was continued for ninety-six hours, during which the animals took their food, arranged their bedding, and behaved in every way as mice under confinement are accustomed to do. After the conclusion of the experiment they were kept for several days and remained apparently in perfect health.

culty will depend largely upon the exact mechanical conditions present. If the obstruction is partial and is of such a nature that air, once having passed it, can then have unrestricted access to the alveoli, an almost normal respiratory relation can be re-established by adding enough oxygen to the respired air to compensate for the diminished quantity of the latter. But if the obstruction is complete, or practically so, in any part of the lung, or if it extends into the air-cells themselves, the case is quite different. Such a condition involves a lessening of the respiratory surface, which means much more than a mere narrowing of the air-passages.

It is essential to remember that normal respiration requires that a normal amount of oxygen shall be brought into relation with a normal quantity of blood. Now we possess the means of remedying to a certain extent a deficiency of air, since we can make a reduced volume contain the full amount of oxygen. But we have no power to act in a corresponding way upon the blood, for it cannot be made to take up an excess of oxygen in one part of the lungs to compensate for a deficiency in another. Suppose, for instance, the lumen of the trachea should be diminished experimentally one-half, we could double the proportion of oxygen in the air, and the respiratory demand would be satisfied. But suppose that, instead of narrowing the trachea to one-half its transverse area, we should cut off one-half the supply of blood to the lungs by clamping one of the pulmonary arteries. The resulting dyspnœa now would not be relieved by any amount of oxygen added to the respired air, for the reason that the blood circulating in the other lung would refuse to absorb more than the usual proportion of the gas, and the process of aëration of the blood would be only one-half accomplished. We might vary the first experiment by leaving the trachea unobstructed, but closing entirely one of the primary bronchi. This would cause about the same reduction of the quantity of air inhaled, but at the same time it would throw out of use one-half of the pulmonary capillaries. In this case, as in the last, the addition of oxygen would fail to give relief, and for a similar reason.

It is not strictly true that when a diminished supply of air is compensated by the addition of oxygen the normal respiratory conditions are re-established. To be entirely satisfactory the respirations must have the normal amplitude. This is necessary to give the free play to the lungs which is required for a proper distribution both of the air and the blood to all parts of the pulmonary structure. But the trouble from this source is not urgent and can very well be tolerated for a considerable time.

Applying these considerations to the conditions occurring in acute respiratory disease, we find them amply sustained by clinical results. The dyspnœa of membranous croup is at once relieved by oxygen if enough be given to compensate for the diminished supply of air. Once get the required amount of oxygen past the obstruction and the respiratory distress ceases. The same is measurably true in bronchitis. In this affection the secretion is rarely in sufficient quantity to entirely obstruct even the smallest tubes, and a way is left open by which the oxygen can reach the alveoli. There it meets an adequate supply of blood, and the process of hæmatosis goes on in a fairly normal manner.

But in pneumonia the case is entirely different. Here the air-cells become filled up with the exudate, and access to the respiratory surface is barred. The situation is similar to that in the last experiment, and so much of the dyspnœa as depends upon the consolidation will remain in spite of oxygen used ever so freely. This is not to say, however, that no good comes from its use in lobar pneumonia, as there is almost always a certain amount of bronchitis or œdema present at the same time, which adds more or less to the respiratory embarrassment.

Its value in these diseases rests on a broader foundation than is immediately apparent. It is not alone that it tends to avert suffocation. Indeed, it is very seldom that a patient with pneumonia, for example, dies directly from deprivation of oxygen. As a rule, before death from actual suffocation takes place the heart, and particularly the right heart, gives out, and the fatal result is from asystole. This exhaustion of the right heart is a gradual process, and is brought about by the increased

muscular effort required to propel the blood through the affected lung. The pulmonary ischæmia is made up of two factors, one of which is the obstruction of the vessels, and the other, and a very important one, is the sluggishness with which blood not duly aërated circulates even through unobstructed capillaries.

It is in the relief of this latter condition that oxygen is most valuable. The moment the arterialization of the blood is improved the circulation becomes easier and the labor of the right heart is lightened. It is a serious error, however, to defer the use of oxygen until the dyspnœa has become urgent. By its timely employment the cardiac force can be conserved and congestion of the unaffected lung territory is in a great measure prevented. But inasmuch as blood, even under the most favorable conditions, will not take up an excess of oxygen if we delay too long and suffer the access of air to become too much restricted, no addition of oxygen acting upon the limited quantity of blood circulating in the lungs will suffice to restore the balance and regain the ground which has been lost.

While the results obtained from oxygen in the croupous form of pneumonia may not be so favorable as in the bronchial, still it is capable of rendering valuable aid in a large proportion of cases. A common source of disappointment lies in reserving its use until a period when, for reasons already considered, its value is comparatively limited. Even in those cases it may serve to bridge over a time of special danger, but the best results are obtained when it is given more or less freely from the moment that it becomes clear that the case is one of more than moderate severity. Its good effects will be shown in lessened frequency of the pulse and respiration, a better color of the face and lips, and fewer moist râles in the chest.[1]

In spasmodic asthma it would seem as if the conditions were such as to insure most satisfactory results from the use of oxygen, and in practice relief is generally obtained from it almost immediately. But there are cases in which it does very little

[1] For a full discussion of this point see an article written by the author in the New York Medical Gazette, December 18, 1870.

good, if any. Repeatedly witnessing such paradoxical results has led me to ask myself whether there may not be a form of asthma in which the spasm includes the bloodvessels of the lung as well as the air-tubes. I cannot otherwise explain why cases apparently similar to others which yield at once to the gas should be entirely rebellious to its influence.

In using the compressed gas it is allowed to escape from the cylinder through a wash-bottle, the valve being so adjusted that the gas bubbles gently through the water. From the wash-bottle the gas is carried to the patient's mouth through a flexible tube provided with a mouthpiece of glass or hard rubber. If the patient is in a condition to hold this in his mouth no more will be required; otherwise it must be held by an attendant in such a position that the escaping gas will be drawn into the lungs with the current of inspired air.

A still better way, especially if the patient is comatose, is to pass a small flexible catheter through one nostril into the naso-pharynx and to connect this with the wash-bottle. In this way very little of the gas is wasted.

If it is desired to add any volatile substance to the gas inhaled, a solution containing it may be made to replace the water in the wash-bottle.

There is no advantage in the lavish use of the gas, as the blood will take up only a very limited amount. If it escapes too freely it adds to the sensation of breathlessness, as is the case when one faces a strong wind.

Only pure oxygen should be employed. The addition of nitrous oxide, with the idea that it is more soluble in the blood, should be condemned, as the oxide is useless for the purpose of respiration, and interferes with the proper interchange of gases within the lungs.

In pneumonia the indication for a resort to oxygen is present as soon as the respirations exceed thirty-five per minute, and earlier than this if mucous râles develop outside of the area of consolidation, or if the lips assume a dusky hue. Under these conditions it may be given continuously or during a prescribed number of minutes each hour.

SANATORIA AND SPECIAL HOSPITALS FOR THE POOR CONSUMPTIVE AND PERSONS WITH SLIGHT MEANS.

By JAMES M. ANDERS, M.D., LL.D.,
PHILADELPHIA.

At the very outset it is worthy of note that underlying the diversity of opinion concerning certain details there is a unity of thought among phthisio-therapeutists as to the superiority of institutional treatment of pulmonary tuberculosis over the ordinary methods.

The accumulating scientific knowledge and practical observations of the last quarter of a century have been preparing thoughtful and progressive physicians for a movement favoring hospital and sanatorium treatment. These new methods have not been advanced suddenly and without premeditation; from an evolutionary stand-point they have not been a "short and easy thing," but have been based upon an increasing exactness of knowledge concerning the infectious nature of tuberculosis, the factors entering into susceptibility to the disease, the conditions favoring its spread and those that are antagonistic, the doubtful utility of so-called specific remedies, the value of hygienic improvements, of fresh, pure air, and the precise arrangement of every hygienic and dietetic detail. As the facts enumerated were more and more fully appreciated in the past, special hospitals and sanatoria were at length provided for tuberculous patients; it was the amalgamation, so to speak, of the long list of successive truths previously established bearing upon an ubiquitous human affliction that prepared the way for the recognition of the true principles of treatment as expressed in well-arranged institutions. In view of this fact, it seems to me that, although little provision has been made for the institutional treatment of tuberculous cases, particularly

in America, we are entering upon a new era in the management of phthisis, and one that offers most promising results; a gleam of hope and brightness we may venture to believe has fallen upon a hitherto most unfortunate class stricken with a serious malady.

To England belongs the credit of having been the first to provide special hospitals for the poor and needy consumptive, and whilst the object of that municipal provision has long since commended itself to the practical judgment of progressive physicians and sanitary officials alike, yet little has been accomplished elsewhere in the direction of establishing charitable institutions of this sort. In an article on "Hospitals and Sanatoria for Consumptives Abroad," read before the Boston Society for Medical Improvement, December 13, 1897, Dr. Edward O. Otis[1] gives a graphic description of the four London hospitals for chest diseases—the Brompton Hospital, City of London Hospital, Royal Hospital, and the North London, at Mt. Vernon, Hampstead Heath. These institutions "are supported by voluntary contributions, with more or less of a fixed income from invested funds," and "all are practically free, a nominal charge of a few shillings being made in a few, with an entrance fee."[2]

The value of special hospitals for the care and treatment of consumptives is emphasized by L. F. Flick,[3] who says: "In England during the last forty years there has been a reduction of 50 per cent. in the mortality from tuberculosis, as a result of isolation in special hospitals." This writer continues: "In the Kingdom of Naples the disease has been nearly exterminated in one hundred years by a system of isolation and disinfection or, rather, destruction of infected material." To prove what can be accomplished to diminish the mortality from phthisis by the creation of special hospitals, Dr. Tatham, inspector in the office of Register-General of England and Wales, has furnished to Dr. S. A. Knopf[4] the following statistics for those two countries.

[1] Boston Medical and Surgical Journal. March 4 and April 7, 1898.
[2] Loc. cit., p. i. [3] "Prevention of Tuberculosis," by L. F. Flick, 1890.
[4] "Sanitariums for Consumptives." New York Medical Journal, October 5, 1895.

MORTALITY BY PULMONARY PHTHISIS FOR 1,000,000 INHABITANTS.

1870	2410
1875	2202
1880	1869
1885	1770
1890	1682
1895	1468

Says Archibald Kerr Chalmers:[1] "From 1860 to 1895 there has been a reduction in the deaths from tuberculous disease of 39.1 per cent. in England and Wales; in Scotland of 36 per cent." I have found from an examination of the literature and of the available official statistics that in all great cities in which active measures have been adopted to obviate the spread of tuberculosis, particularly in London, Berlin, Glasgow, and New York, there has taken place a decided though gradual decrease in the death-rate from this fell disease.

The subjoined table shows the steady decrease in the number of deaths from pulmonary consumption in Philadelphia, of both sexes, for twenty years (though but feeble steps have been thus far taken to prevent the spread of tuberculosis), beginning with 1876, when the increase in population is taken into consideration.[2]

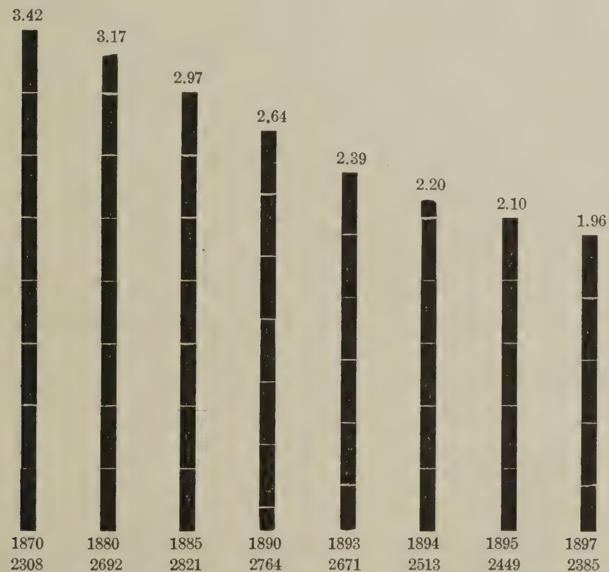
Year.	Population.	Males.	Females.	Total.
1876	825,594	1288	1388	2676
1877	850,856	1142	1207	2349
1878	876,118	1154	1337	2491
1879	901,380	1233	1248	2481
1880	846,980	1325	1367	2692
1881	868,000	1358	1410	2768
1882	886,539	1382	1427	2809
1883	907,041	1343	1455	2798
1884	927,995	1395	1406	2801
1885	949.332	1346	1475	2821
1886	971,363	1468	1300	2834
1887	993,801	1437	1363	2800
1888	1,016,758	1404	1291	2695
1889	1,040,245	1297	1235	2532
1890	1,046,964	1457	1307	2764
1891	1,069,264	1380	1256	2636
1892	1,092,168	1464	1245	2709
1893	1,115,562	1435	1236	2671
1894	1,139,457	1342	1171	2513
1895	1,163,864	1320	1129	2449
1896	1,168,793	1341	1173	2514

[1] "The Causation of Tuberculosis and its Prevention by Legislation." Practitioner, June, 1898.

[2] Modified from the annual report of the Bureau of Health, Philadelphia, 1896.

Dr. Guy Hinsdale[1] has prepared the appended chart, which presents in a clearer light this progressive decline in the mortality.

Chart Showing the Steady Reduction in Deaths from Consumption per thousand of Population, Philadelphia, 1870–1897.



Total deaths from phthisis.

The rate of decrease in the death-rate from phthisis in Philadelphia has been more gradual than in certain other leading municipalities—*e. g.*, London and New York—and the principal reason is that special hospitals for the reception of patients suffering from this disease do not exist to a similar extent in the former city. If any additional evidence be needed to show that special hospitals for pulmonary tuberculosis lessen the mortality from this disease, it is furnished by the well-established law that the disease clings with great tenacity to private houses, unless proper sanitary measures be

[1] Report of the Pennsylvania Society for the Prevention of Tuberculosis, 1898.

introduced, so that one case in a given house is apt to be followed by a second, and the greatest danger to the healthy individual is protracted exposure to the bacillus-laden atmosphere of an infected house or apartment. Arthur Ransome[1] remarks pertinently: "Most of the differences in tuberculosis rates of localities are due to the greater or less healthfulness of the occupations, to the amount of air-space in the workshops, the cleanliness of the surroundings, the nature of the dust to which the work gives rise; but another, and perhaps a still more important, factor in the production of tuberculosis is the existence in certain localities of infected houses, or even of infected areas." Such observations render it clear that isolation and disinfection are imperatively demanded for the thorough accomplishment of an early extermination or greatly diminished diffusion of the disease.

Hospitals for consumptives, however, located in densely populated centres do not offer advantages in any wise comparable to those of modern sanatoria situate in a suburban locality, affording a purer atmosphere and improved environing conditions. The principal objects of this paper are to show the paramount value of sanatoria and the urgent necessity for the construction of an adequate number of these institutions for the treatment of consumption in its earlier stages, in persons having small means and in the needy poor, although the best means of caring for the advanced cases (in special hospitals) will also be indicated.

The Adirondack Cottage Sanatorium, under the direction of Dr. E. L. Trudeau, is a good example, of which more are urgently needed; only patients are admitted who cannot pay more than five dollars per week, thus enabling those possessed of limited means to obtain the superior advantages of a favorably located, well arranged, and well officered sanatorium. There is, additionally, a small free-bed fund "which varies according to the yearly contribution, and there are generally at the institution from five to six beds filled by free patients."

[1] "The Susceptibility to Tuberculosis under Different Conditions," quoted in the Philadelphia Medical Journal, July 16, 1898.

In answer to a personal letter of inquiry, Dr. Trudeau writes: "It is true that only a small percentage of the cases requiring such treatment can be admitted to the sanatorium, and the applications are greatly in excess of our accommodations." It is a lamentable fact that for the great host of tuberculous poor there is an almost absolute lack of special sanatorium accommodation in this and most other countries. The patients belonging to this category who are not provided for constitute sources of danger to well persons, and even to susceptible individuals occupying a higher social rank, and who, although acquainted with the means of prevention, are unavoidably exposed to the infection as the result of contact in the ordinary pursuits of life. Embodied in a report of the Board of Health of the City of New York to the Mayor, and included in the measures subsequently adopted by the said Board for the prevention of pulmonary tuberculosis, I find this statement: "We are convinced that no other factor is so potent to-day in perpetuating that ominous death-list from pulmonary tuberculosis as the lack of proper facilities for the *poor* (italics mine) of this city stricken with this malady."[1]

The most trustworthy test of the combined sanatorium and climatic treatment has been made at the Adirondack Cottage Sanatorium (before referred to), and as the working-class of patients only are there admitted, the results obtained at that institution may be taken as a safe and true index of its value. "Little stress is laid on the administration of drugs, except when necessary to relieve symptoms, but cod-liver oil, the hypophosphites, and arsenic are quite generally made use of." The practical results are thus fairly and conservatively given by Dr. E. L. Trudeau:[2] "If all attempt at classification is abandoned, and the gross results obtained in all patients admitted to the sanatorium are considered, it may be stated approximately that 20 per cent. are apparently cured, and that in 30 per cent. more the disease is more or less perma-

[1] Communication to the Board of Health of New York, January 11, 1897, by Hermann M. Biggs, M.D., and T. Mitchell Prudden, M.D.

[2] "Sanatoria for the Treatment of Incipient Tuberculosis." New York Medical Journal, February 27, 1897.

nently arrested. If the most favorable of all cases admitted are separated under the term 'incipient,' the proportion of cures would be as high as from 30 to 35 per cent., and the importance of making an early diagnosis and of the immediate application of radical measures is strongly emphasized by this experience." From the latter statement it is seen that of the earlier "incipient" cases, in addition to the 30 to 35 per cent. of cures, "in 30 per cent. more the disease is more or less permanently arrested." As to the practical value of this method, Trudeau further says:[1] "The best results in treating incipient tuberculosis are obtainable in special sanatoria situated in good climates."

In Dr. Brehmer's Sanatorium at Goerbersdorf, founded in 1859, from 24 to 44 per cent. of the cases were apparently cured or had the disease arrested. Alpine sanatoria show even better results.[2] Otis[3] states that the results of Falkenstein "from 1876 to 1886, of the patients who have been kept under observation since their discharge, are 13.2 per cent. of complete cures and 11 per cent. of relative (arrested), a total of 24.2 per cent.; 60 per cent. or more are improved." Again, at Hohenhonnef about 15 per cent. are considered cured and 68 per cent. improved. The average duration of residents at the two last-mentioned sanatoria is only three months. It is not necessary at the present time to multiply examples clearly to demonstrate the power of well-organized and intelligently administered sanitariums to benefit, arrest, and even absolutely cure pulmonary tuberculosis. I might have, had I deemed additional evidence important, selected additional institutions whose results are still more strikingly favorable than those already cited (*e. g.*, Winyah Sanitarium, at Asheville, under the charge of Dr. von Ruck,[4] and the Loomis Sanitarium for Consumptives[5]). Hermann Weber,[6] after an extensive per-

[1] Loc. cit.

[2] F. Rufeknacht Walters: "Sanatoria for Consumptives." Practitioner, June, 1896.

[3] Loc. cit., p. 23.

[4] I am aware that the basis of treatment at this institution cannot be said to be climatic and dietetic merely.

[5] Dr. J. Edward Stubbert: "Methods of Treatment at the Loomis Sanitarium for Consumptives." Philadelphia Medical Journal, March 2, 1898.

[6] Philadelphia Medical Journal, July 16, 1898.

sonal experience, holds that "treatment at good sanatoria promises more that ordinary treatment at hotels and 'pensions' without strict medical supervision."

To show the imperative necessity for the creation of these eminently satisfactory institutions, I need only to point to the methods generally in vogue in the United States, France, and other countries, either of segregation in separate wards of general hospitals, or, as unfortunately happens still, of admission into the wards occupied by those ill of other diseases. In this connection it is but fair to state that the obvious element of danger to patients stricken with other forms of illness in a ward from the presence of a consumptive is probably quite generally appreciated at the present time by the medical staffs of our general hospitals, but in many instances separate wards cannot be furnished. In the absence of special accommodations the consumptive either meets with a denial of admission to those institutions (*e. g.*, in the Presbyterian, Howard, and Pennsylvania, and other hospitals of Philadelphia—*vide* table) or he is allowed to occupy a bed by the side of those who are at the time susceptible to tuberculosis (*e. g.*, patients afflicted with typhoid fever, influenza, diabetes mellitus). To show that it is not a gratuitous assumption to claim that little appropriate provision has been made for this large class of consumptives, I have collated facts and data which cannot fail to carry conviction. In the city of New York the Department of Public Charities is not able to provide separate accommodations, "excepting to the most limited extent, even for advanced cases, and, as a result, actual isolation does not exist in any of the municipal institutions. In every one of the institutions of the Department of Public Charities and the Department of Correction consumptives are found occupying beds in general wards of the various hospitals, associating with healthy prisoners in the cells, and in the greatly overcrowded workrooms of the workhouse and the penal institutions."[1] As will be seen hereafter, however, New York City, through the

[1] Communication to the Board of Health of New York City, by H. M. Biggs and T. M. Prudden, 1897.

continued efforts of its health department, has secured an annual appropriation for the support of a small percentage of the poor consumptives in special hospitals. That city has, comparatively speaking, the best accommodations in the form of special hospitals (*vide infra*). The table following is clearly indicative of the lack of special hospital accommodation for consumptives in New York City, though far in excess of that afforded by other cities. It also proves that the doors of the general and many of the "city" hospitals are closed to consumptives without means.

New York Hospitals.

Name of institution.	Cases of pulmonary tuberculosis admitted.	Admitted into general wards.	Special provision.
Roosevelt Hospital,	Yes (all stages).	Yes.	No.
Metropolitan Hospital,	Yes (all stages).	No.	Special wards.
Harlem Hospital,	Yes.	Yes.	No.
Colored Home and Hosp.	Yes.	No.	Special wards.
Beth-Israel Hospital,	Yes (a few).	Yes.	No.
Almshouse,	Yes.	No.	Separate pavilions and tents.
St. Luke's Hospital,	Yes.	No.	Special wards.
Montefiore Home,	Yes.	No.	Separate wing of building.
New York Hospital,	Yes (a few as emergency cases).	Yes (fair sanitary precautions).	No.
St. Mark's Hospital.	" " "	" " "	No.
Presbyterian Hospital,	" " "	" " "	No.
Mount Sinai Hospital,	" " "	" " "	No.
German Hospital,	" " "	" " "	No.
Bellevue Hospital,	" " "	" " "	No.

In reply to a letter of personal inquiry, Dr. Vincent Y. Bowditch, of Boston, stated: "There is a lamentable lack of hospital accommodation here for the poor consumptives, the only institutions of the kind in the city being three comparatively small ones for advanced cases. Tuberculous cases are received in most of the hospitals here when not in the advanced stages, but no special provision is made for them, I regret to say, and the cases are received in the general wards."

The following is a tabulated statement of the conditions under which consumptives are received, if at all, in the principal hospitals of Philadelphia, and of the special facilities afforded for their care and treatment:

PHILADELPHIA HOSPITALS.

Name of institution.	Cases of pulmonary tuberculosis admitted.	Admitted into general wards.	Special provision.
German Hospital,	Yes (all stages):	No.	Special wards with special nurses.
Episcopal Hospital,	" "	Yes.	No.
Howard Hospital,	No.	No.	Any cases discovered are put into a separate room.
Methodist Hospital,	Yes (incipient stage only).	Yes (observe rigorous disinfection).	No.
Pennsylvania Hospital,	No.	Cases discovered are treated in general ward.	No.
Presbyterian Hospital,	No.		
Medico-Chirurg. Hosp.	Yes (during winter season for class demonstration).	Yes (observe rigorous disinfection).	No.
Philadelphia Hosp.	Yes (all stages).	No.	Special wards.
Jefferson College Hosp.	Yes (incipient only).	Yes.	No.
St. Joseph's Hospital,	No.		
St. Agnes' Hospital,	Yes (all stages).	No.	Special wards.
Samaritan Hospital,	No.	Cases discovered treated in general ward (strict disinfection observed).	No.
University Hospital,	Yes (only during winter for class demonstration).	Yes (strict disinfection observed).	No.
Polyclinic Hospital,	No.	Cases discovered treated in general wards.	No.

This table proves that not a single general hospital in Philadelphia is competent to treat properly consumption in its earlier stages; six of these institutions refuse to accept them in any stage, three have provided special wards, two treat only early cases in the general wards, while three admit them in the general wards in all stages of the disease. But it is not necessary to analyze this table any further; it speaks for itself, and in no uncertain tones, rendering clear the backwardness of Philadelphia with reference to proper facilities for the treatment of phthisis.

The high mortality-rate of pulmonary tuberculosis, particularly among the lower class, under existing methods of treatment, is another reason that justifies an appeal to the benevolent and philanthropic for immediate action. For example, in Philadelphia the average number of deaths from all causes

during the ten years ending January 1, 1897, was 22,614, while the average from consumption during the same period was 2628 cases, or 11.6 per cent. of the total death-rate.[1] The percentage of all deaths due to pulmonary consumption in adult life, however, is much higher than stated above, and this is especially true of the needy class and those with slight means.

The following data have been obtained from the records of the Philadelphia Hospital, which receives only the city's poor stricken with phthisis, through the kind aid of Dr. A. C. Morgan, the resident physician: "During the six months ending June 30, 1898, seventy-one patients died in the special consumptive wards, and during the same period seventy-five were discharged, with fifty-two patients in the wards, June 30th." Again, the average percentage of the total death-rate in the Philadelphia Hospital in recent years was 19 per cent., hence the percentage of deaths from pulmonary tuberculosis in this institution, to which are admitted only the pauper class, is nearly double that of the city of Philadelphia (11.6 per cent.). Moreover, from the *Monthly Bulletin*[2] of the State Board of Health of New York I gather that in 1896 phthisis caused 10.8 per cent. of the total mortality in that State, and it has varied in past years only from 10.6 to 11 per cent.

The consumptive poor that seek admission into the Philadelphia Hospital are found to be in all stages of the affection, though in the majority of instances, perhaps, they are in the advanced period of the disease. May not the higher percentage of deaths from phthisis in the Philadelphia Hospital, as compared with the percentage of deaths from this disease in the city as a whole, be due to the cases having progressed to a late stage at the time of admission? At first glance an affirmative answer would seem to be the correct one, but a few words of explanation only are needed to permit a fuller appreciation of the facts. As stated before, seventy-five of the phthisical patients in the Philadelphia Hospital were discharged during the six months ending June 30, 1898 (about the same number as died during this period), and a similar

[1] Annual Report of the Board of Health (Philadelphia) for 1896. [2] December, 1897.

showing is made by the figures for 1895 and other previous years. A fair percentage of those discharged are improved, and in a preponderating proportion the discharge is granted upon the patient's own request. Moreover, it is to be recollected that the total annual death-rate for all diseases in the Philadelphia Hospital is inordinately high for the aggregate number of cases treated—a circumstance that tends to lessen the relative percentage of deaths from phthisis in this institution, as does the fact, also, that the average length of sojourn in the Philadelphia Hospital is only about three months. After due allowance is made for all modifying conditions, the data gleaned from the records of the Philadelphia Hospital show the death-rate in tuberculosis among the poor, under existing methods of treatment, to be insufferably high.

Upon examining the official reports it is seen at a glance that the same ratio that was shown to exist between the percentage of the total number of deaths due to pulmonary tuberculosis in Philadelphia and that of the mortality of the Philadelphia Hospital due to the same cause—viz., nearly two to one in favor of the latter institution—obtains as to the question of the frequency of occurrence, the disease being almost twice as common among the lower as the upper class of society. As tending to corroborate the view that the working class and the pauper element, to be found in overcrowded districts, are peculiarly prone to the affection, let me borrow the words of L. F. Flick, a calm, true observer of phenomena concerning tuberculosis in its varied phases: "From my own experience I am under the impression that 75 per cent. of all cases of tuberculosis occur among the poor," and, he adds, "need treatment in properly equipped sanatoria."

The statistics of the Board of Health of New York also show phthisis "to be relatively most prevalent in crowded districts, and, inferentially, among the lower class of people with inferior sanitary surroundings."[1] The accompanying table demonstrates the absolute correctness of this assertion.

[1] F. C. Curtis in response to a written request for information addressed to the Board.

IN EACH 1000 DEATHS FROM ALL CAUSES THERE WERE FROM

Districts.[1]	All zymotic diseases.	Typhoid fever.	Scarlet fever.	Diphtheria and croup.	Diarrhœal diseases.	Consumption.	Acute respiratory diseases.
Maritime	106.00	14.00	15.25	41.00	11.50	130.00	176.20
Hudson Valley	75.00	26.65	2.25	42.25	15.50	110.00	165.00
Adirondack and Northern . .	75.00	15.00	......	32.50	12.00	97.50	172.50
Mohawk Valley	82.00	27.50	2.30	20.50	25.00	93.50	143.20
Southern Tier	107.00	18.60	7.00	35.00	16.25	51.15	125.60
East Central	86.00	30.00	2.25	22.50	13.50	92.25	175.00
West Central	45.00	14.00	......	13.50	......	92.25	135.00
Lake Ontario and Western .	90.00	24.25	3.65	32.75	18.20	100.50	175.75

In response to a note of inquiry, Dr. Leroy W. Hubbard informs me that "in 1897 there were reported to the Sanitary Board of New York City 9708 cases of pulmonary tuberculosis, and indications are that the number this year will be about the same." As the majority of these cases are from the various charitable institutions, this statement represents fairly the number of poor consumptives in that city.

The data collated in the table below show the number of cases of phthisis treated in the out-service of the principal hospitals of Philadelphia for a term of years; also the percentage of cases of the whole number of medical cases treated in these dispensaries. It is not claimed that the statistics compiled below represent accurately the number of poor consumptives in Philadelphia, since many of the patients probably made application at more than one institution during a year, and others (about 5 per cent.) came from points beyond

[1] The sanitary districts into which the State is divided are as follows: Maritime District: Includes New York, Brooklyn, Long Island, Staten Island, and Westchester county. Hudson Valley District: All the counties on either side of the Hudson River, except Westchester, to and including Albany and Rensselaer. Adirondack and Northern District: The northern section of the State—the counties of Washington, Warren, Hamilton, Essex, Clinton, Franklin, St. Lawrence, Jefferson, and Lewis. Mohawk Valley District: Schenectady, Schoharie, Saratoga, Montgomery, Fulton, Herkimer, and Oneida counties. Southern Tier District: The seven counties along the southern border of the State. East Central District: Sullivan, Delaware, Otsego, Madison, Chenango, Onondaga, and Cortland counties. West Central District: Cayuga, Tompkins, Seneca, Schuyler, Ontario, Yates, Livingston, Genesee, and Wyoming counties. Lake Ontario and Western District: Oswego, Wayne, Monroe, Orleans, Niagara, and Erie counties.

the limits of the city. On the other hand, by no means all of the working class afflicted with phthisis receive treatment at the various charities, so that the various figures given below are far from being in excess of the actual number of poor phthisis patients, and yet they serve to indicate how numerous the walking patients are, who for their own interests and those of the public ought to be treated in special hospitals or sanatoria, and thus the disease be more rapidly excluded from the mortuary records.

Name of institution (out-service).	Number of years.	Total No. of medical cases (new) treated (out-service).	No. of consumptives treated (out-service).	Percentage of cases of phthisis.	No. of cases of tuberculosis treated in the wards.
Episcopal Hospital,	10 years (1888–1898)	142,838	2300	1.61	673
Medico-Chirurg. Hosp.	5 " (1892–1897)	6,294	334	5.30	
Howard Hospital,	5 " (1893–1898)	13,262	490	3.69	Don't admit.
Pennsylvania Hospital,	10 " (1888–1898)	21,483	670	3.11	341
Samaritan Hospital,	5 " (1893–1898)	1,916	68	3.54	Don't admit.
German Hospital,	8 " (1889–1898)	11,223	704	6.27	856
Presbyterian Hospital,	1 year (1897)[1]	2,229	54	2.34	32
University Hospital,	5 years (1893–1898)	9,784	1103	10.25	140
St. Joseph's Hospital,	2 " (1895 & '96)	1,123	74	6.58	36
Jefferson College Hosp.	5 " (1893–1898)	16,990	1318	7.75	64

Biggs[2] and Prudden state that nearly 9000 cases of tuberculosis were reported to the bacteriological laboratories of the Health Department of New York City in 1896, and nearly 6000 deaths resulted from this disease. They continue: "It is conservatively estimated that at least 20,000 cases of well-developed and recognized pulmonary tuberculosis now exist in this city, and an additional large number of obscure and incipient forms of the disease."

Having reviewed at considerable length the existing conditions, and having demonstrated that they fall short of the requirements and advantages necessary for the successful treatment and care of the consumptive poor, the query arises, What

[1] Other years dispensary cases not tabulated under separate heads.
[2] Loc. cit., p. 29.

is the remedy? Obviously, to do nothing or to continue to maintain an indifferent attitude toward the question means, on the part of any professional organization or municipality, retrogression. Increased accommodation for the reception and treatment of consumptive patients is an imperative necessity, and in attempting to answer the query I proposed before, I shall classify the cases into three large groups, and point out the provision that should be made for each respectively.

Group I. To this category belong the cases that have reached an advanced stage; the disease is neither curable nor arrestable, as a rule; they form a distinct class, considered from the stand-point of treatment, and need only to be made comfortable until death terminates all. These patients do not require climatic sanatoria, but special hospitals are necessary in order to cut off every possible channel of communication for the infection between themselves and healthy uninfected individuals, and this I hold to be impossible if admitted into general hospitals, however carefully they may be segregated. The few cases belonging to this class in which marked improvement followed confinement in a special hospital should be removed to a sanatorium, or, in other words, they should be treated in the same manner as Group II. (*vide infra*).

The St. Joseph's Hospital for Consumptives, in New York City, where the patients received are, for the most part, in an advanced stage of the disease, is doing laudable work, and is the kind of institution to meet the demands of this group. Not less than 1500 consumptives are annually admitted here, at an average daily cost of fifty cents per capita. New York City also affords two other hospitals devoted exclusively to the treatment of consumptives, namely, the Seton Hospital, Spuyten Duyvil (150 beds); the Loomis Sanitarium (New York branch for incurables, with about 50 beds). Again, the Department of Health, New York City, has constantly in the Seton Hospital and the Colored Home and Hospital about eighty patients, whose care and maintenance are provided for by an appropriation, at the rate of one dollar per day. For the care of the consumptive poor of New York City there are

approximately 1000 beds in the different hospitals. It might be mentioned in this connection that the subject of the proper treatment of consumptives is at present also claiming the attention of the health authorities of the State of New York, and, speaking with reference to the United States only, that State is in the vanguard so far as special and general measures to prevent the spread of phthisis are concerned. As I said before, in the quotation from Dr. Bowditch's communication, there are three comparatively small special hospitals for advanced cases in Boston, the largest being the Free Home for Consumptives, in Quincy Street, Dorchester, an admirable (private) institution.

The Rush Hospital for Consumptives, in Philadelphia, with an average of fifteen cases, aims to admit only the most hopeful cases, but examples of advanced pulmonary tuberculosis are often received, owing to the irresistible pressure of influence. At Chestnut Hill, near Philadelphia, there is a hospital for the consumptive poor, under the control of the Philadelphia Protestant Episcopal Mission, where patients in all stages of the affection are treated.

According to the ground here taken, a municipal hospital for the consumptive poor, while a most praiseworthy charity, should, in order to accomplish the most good and to work the least harm, admit only patients in the last stage of the disease. There is demanded the creation of special climatic sanatoria for the treatment of the earlier stages.

The consumptive patients among the lower class, in the incipient[1] stage, give us two additional groups when therapeutically considered; Group II., the pauper class, or the true wards of the city or State (these are at present compelled to seek admission to the general hospitals, without success as a rule, except in the case of the purely public charities), and Group III., those possessing small means, and composed largely of skilled mechanics and the working class.

From the facts previously adduced concerning, first, the excellent results obtained in climatic sanatoria; second, the

[1] I here employ the term "incipient" for the most favorable cases, rather than the first pathologic stage.

relatively increased prevalence and mortality of phthisis among the lower class in overcrowded localities; and third, the utter lack of special sanatoria for their accommodation, it is clear that for the latter groups there should be provided without delay appropriate institutions. It is equally clear that as a first step a strong and universal professional sentiment in support of the treatment of this disease in sanatoria is necessary; a more crying need, however, is a healthy, aggressive public sentiment, but to bring about the latter time and the combined and well-directed energies of local and general boards of health, of health officers, and the progressive element of the medical profession are required. Happily, sanitary authorities are alive to the necessity for the adoption of suitable restrictions to diminish the prevalence of this dread disease; and they can do much by formulating ordinances, the distribution of circulars of information, etc. Says Dr. Benjamin Lee:[1] "Those whose official positions make it their duty to do all in their power to extinguish disease, diminish the death-rate, and prolong longevity, entertain convictions so positive as to lead them to believe in the possibility of the adoption of measures which shall restrict the spread of disease, and thus add an incalculable number of years to the aggregate of human life." The health authorities of the city of New York have taken advanced ground, and very properly placed pulmonary tuberculosis among notifiable diseases.

I heartily approve of the recommendation frequently made by sanitarians, that practical information and suggestions concerning the best means to be adopted to limit the ravages of this fell affection should be systematically and earnestly diffused, until the required knowledge, particularly with reference to the value of such measures as isolation, hygiene, and climate, shall have been thoroughly popularized; yet I am wholly convinced that to ripen sentiment, and to gain the approval of the masses in the movement to secure this ideal plan of treatment,

[1] "The Present Attitude of Sanitarians and Boards of Health in Regard to Pulmonary Tuberculosis." Journal of the American Medical Association, October 30, 1897.

it will be necessary to pursue an educational policy for years to come. Conversely, it is to be recollected that, as pointed out by Trudeau,[1] "the education the patients receive at the sanitarium as to the nature of their disease and the methods to be relied upon in combating it is of the utmost value to them in enabling them to care for their health and avoid relapses after they have left the institution." Doubtless the erection and maintenance of an adequate number of sanatoria would prove to be the means, also, of educating the communities in which they might be located.

While it were most desirable that Group II., composed of the pauper element of society afflicted with incipient tuberculosis, should receive the benefits of sanatoria situated in the best climates, it is scarcely feasible. Fortunately, the results obtained at sanatoria situated near large cities, in localities devoid of special climatic advantages, but having a comparatively pure, fresh atmosphere, are also surprisingly good. Witness the Sharon Sanatorium which is situate a few miles from Boston, under the charge of Dr. Vincent Y. Bowditch; it reports 25 per cent. of arrested cases, and a much greater percentage of improvements.

Hence, whilst the basis of the typical plan of treatment is hygienic, dietetic, and climatic, we can, by paying attention to the selection of a favorable location in an easily accessible rural district, preferably one well sheltered in the woodland, secure a uniform temperature and a purified atmosphere. I have elsewhere shown that forests tend to maintain an equability of climate, both as to temperature and relative humidity, so that forest resorts possess certain unmistakable advantages for the consumptive sufferer, particularly pine groves, on account of their terebinthinate exhalations.[2]

At sanatoria the hygienic details, including an appropriate dietary, are rigorously carried out under the constant surveillance of a competent medical officer, and right here lies the

[1] Loc. cit., p. 14.
[2] "House Plants as Sanitary Agents; Sanitary Influence of Forest Growths," by the author, p. 312.

principal reason why excellent results are so uniformly obtained; and whilst these institutions should be invariably under State and municipal authority, I feel convinced that the group of cases under consideration (the pauper element of society in the earlier stages) should not be treated in cities, but in sanatoria near them, and always in the best available climate. This class of patients should perform certain duties under the direction of the physician in charge that would diminish the current expenses of the institution. The cities pursuing this plan for incipient or favorable cases could furnish accommodation in the form of sanatoria for little if any additional outlay, since the expenses per capita would be but little in excess of that required to keep them in general, city, or almshouse hospitals with their antihygienic surroundings. Unquestionably, any method of treatment that would greatly increase the percentage of "cured" or "arrested" cases among the poor would tend to lessen municipal poverty, on the one hand, and, as a natural corollary, would save the community needless expenditures for the support of families left without a head, on the other.

For Group III., or persons having slight or comparatively small means, who could afford the expense of from five to ten dollars per week, sanatoria in a good climate are urgently needed.

I have previously quoted the results obtained at Sharon, Massachusetts, from the sanatorium treatment of phthisis near large cities. Dr. Vincent Y. Bowditch,[1] who is the medical director of the Sanitarium for Pulmonary Diseases, wisely remarks that he "should not be so foolish as to claim results equal to those coming from a radical change of climate, such as is possible for the wealthier classes;" he contends, however, that what has been accomplished at Sharon is vastly more satisfactory than any attempt to treat patients at their homes, or in the office, in this part of the country.

This sanitarium has been established for the treatment of

[1] "The Treatment of Phthisis Near our Homes." Read at the annual meeting of the Massachusetts Medical Society, June 10, 1896.

incipient pulmonary diseases only in patients who are in reduced circumstances, advanced cases not being admitted. Institutions of this character are entirely suitable for patients belonging to Group II., or those who cannot afford to pay any price for board; for Group III., however, or persons possessing small means, it was desirable, and it is entirely feasible, to supply similar institutions in localities presenting claims to climatic advantages. Dr. Bowditch has shown that "the sanatorium treatment of consumption, even in harsh climates, takes a very high rank among the methods of combating the disease," and this opinion I strongly indorse as being the best mode of treating phthisis in the dependent class. I am also in full accord with those who look upon phthisis as an infectious and contagious disease demanding the enforcement of isolation and disinfection to limit its spread.

Granting these dicta, it is my earnest hope that the therapeutic importance of pure air, an equable and cold climate, abundance of sunshine, and moderate elevation, in combination, to the phthisical invalid will not be underrated, in view of the importance now justly given to the effects of a rigorous hygienic regimen under the close supervision of a competent medical officer. It seems to me we should hold fast to the well-founded and reasonable opinion, that whenever practicable the combined climatic and hygienic treatment is to be advised and adopted.

It is for these reasons that I would warmly advocate the establishment of true *climatic* sanatoria. The expenditure in such institutions would not exceed one dollar per diem for each patient (about the same amount as would keep him in a general hospital), and this would be nearly, if not entirely, covered by the payment of a weekly board ranging from five to eight or ten dollars.

At the present day the danger of contagion from the consumptive (not always immediate, but sometimes remote in point of time) in general hospitals is universally admitted by all progressive physicians. The fact that cases of infection among attendants in special hospitals for consumptives rarely

occur is no argument against the necessity for the separation of consumptives from well persons, but rather an argument in favor of isolation under close medical supervision. The time has come when the apathy and indifference on the part of the medical profession now existing (with few exceptions) should speedily give way to an aggressive movement looking to the proper treatment of consumptives belonging to this group.

Every physician of large clinical experience must have felt keenly in recent times his utter helplessness and inability to furnish proper advice in these instances in the absence of institutions for their reception and treatment. Boards of management of our general hospitals should be entreated to establish for this large class in the immediate future sanatoria in appropriate localities, as special departments, furnished with competent medical officers. Such an undertaking, in the name of sweet charity, would be warmly welcomed by the medical profession; but more than this, it would exert a most beneficent influence *sui generis* in combating the ravages of pulmonary tuberculosis. And whilst it were much to be desired that these institutions might be purely philanthropic in their aims, as in the case of the Adirondack Cottage Sanatorium, if a graded scale of prices, as suggested above, were adopted, the deficiency, if any, in the expenses for professional care and maintenance would be small indeed, and easily met by voluntary contributions.

It would seem that philanthropists owe a duty to this particular class of invalids that has not as yet been discharged. Perhaps they have not appreciated the obligation they owe, because they have not realized the grounds on which it rests. In the case of the Adirondack Cottage Sanatorium liberal responses have followed the appeals of its President and interested friends, and it is probable that like personal sacrifice and efforts on the part of influential members of the profession would accomplish the same good practical results in other States.

That the creation of sanatoria in a given locality tends, in a remarkable degree, to diminish the number of cases of pul-

monary phthisis is strikingly illustrated by the official statistics of the village of Goerbersdorf for a hundred years:

DEATHS FROM PHTHISIS PULMONALIS.[1]

1790–1799	14
1800–1809	5
1810–1819	9
1820–1829	9
1830–1839	8
1840–1849	6
1850–1859	7
1860–1869	4
1870–1879	5
1880–1889	5

Such sanatoria would, in the second place, reduce the enormous death-rate from tuberculosis, in existing and future cases, among the poorer classes, since in properly equipped sanatoria these unfortunate subjects would receive the benefits of the most approved methods of treatment in incipient or favorable stages of the affection. What I have previously stated concerning the practical results in the treatment of phthisis in sanatoria has, I trust, left no doubt in the minds of my readers as to the absolute reliability of this statement.

It is not my purpose to deal here with the subject of the treatment of phthisis among the wealthier classes, who can enjoy the advantages of open-air climatic treatment in the best localities, or the benefits of more elaborate and well-equipped sanatoria, to be found especially in different European countries.[2] But I wish merely to emphasize the earnest hope that private enterprise will speedily create more of these institutions for the well-to-do consumptives also, and thus diminish the danger from the diffusion of tuberculous virus, which must at present result from their occupying boarding-houses and hotels where large numbers of well persons congregate.[3]

In concluding this paper I hold it to be pre-eminently the

[1] Quoted by S. A. Knopf, M.D., loc. cit., p. 463.

[2] A good example of such an institution in this country is the Winyah Sanitarium, near Asheville, North Carolina, under the care of Dr. von Ruck.

[3] Fortunately, certain hotel-keepers already refuse to receive persons afflicted with pulmonary tuberculosis.

duty of the medical profession to seek to promulgate right notions on the treatment and care of phthisical patients among State and municipal legislative bodies, the medical profession at large, and the general public. The most important work, however, now and in the immediate future, is not so much to thus propagate the combined method of treatment here advocated, but to induce the members of the medical profession to translate into active measures the essence of their belief.

An organized effort to bring relief to the large class of sufferers under consideration might, with peculiar appropriateness, be undertaken by such an organization as the American Climatological Association. Its members should individually bear a part of the work; but before they seek to induce State and municipal authorities and philanthropists to participate in the creation of appropriate institutions for the treatment of those ill with phthisis, it is an important matter to consider what are the proper lines on which to work, and to keep in mind modern therapeutic and hygienic demands. It has been my province to point out the course to be pursued in meeting the varied needs of the lower and working classes afflicted with pulmonary tuberculosis; I have endeavored also to emphasize the importance of an explicit recognition of the requirements of the three groups or subdivisions of the cases, based upon such considerations as social station, stage of the affection, and the physical condition of the individual.

Provisionally, the more salient points and inferences brought forward in this paper might be summated in tabular form under two main heads:

(*a*) Those that show the extent and urgency of the needs presented by the large class of phthisical patients previously considered, and the value of special hospitals and sanatoria for their treatment:

1. The statistics adduced here afford clear and convincing proof that pulmonary tuberculosis is proportionately far more common, as well as more inauspicious, among the lower than among the higher classes.

2. The almost absolute lack of proper facilities for the treat-

ment of the poor afflicted with pulmonary tuberculosis, as shown by the tables given above, is a most potent factor in maintaining the enormous death-rate from this disease.

3. Special hospitals in which every hygienic detail can be arranged with precision are far superior to separate wards in general hospitals for the treatment of cases of pulmonary phthisis.

4. The admission to and care of such patients in the wards of general hospitals with those suffering from other forms of illness, as is the custom still in some, and to a limited extent in many, institutions, is to be energetically deprecated. There is serious danger of transmitting the disease under these circumstances, particularly when the breaking-down or suppurative stage is reached.

5. The mortality figures show a reduction of nearly 50 per cent. in consequence of the creation and continued operation of special hospitals for consumptives — *e. g.*, the City of London.

6. Sanitoria near large cities afford better advantages than so-called special hospitals in densely populated centres, whilst climatic sanatoria, if properly situated, properly officered, and well equipped, show results that surpass those of all other known methods of treatment in the earlier or incipient stage of the disease.

7. Sanatoria lessen the mortality-rate of phthisis in communities in which they are situated.

(*b*) Points bearing upon the discrimination of cases, among the lower class, into three groups, and the remedy—an institution with distinctive characteristics—for each :

Group I. The numerous cases that have progressed to an advanced and practically hopeless stage. These require every comfort and kind care, such as can be furnished by special hospitals for consumptives in a healthful urban locality.

Group II. Incipient cases among the pauper element. For such sanatoria conveniently located in close proximity to large municipalities, though with special reference to such factors as purity of atmosphere and protection from chilly blasts, by

natural elevations or the woodland, should be provided. It is not possible to secure for them the most salutary climates.

Group III. Phthisis pulmonalis among the middle and working class, or persons having small means. The members of this group will find themselves compelled to depend principally upon private philanthropy, and probably to some extent also upon semi-State institutions; they need sanatorium treatment in the best climates, and there is no valid reason why the combined sanatorium and climatic treatment should not be attempted, since such an undertaking could be made to be almost self-sustaining.

THE DISTRIBUTION OF TUBERCULOSIS IN NEW JERSEY.

By GUY HINSDALE, M.D.
PHILADELPHIA.

The distribution of tuberculosis in New Jersey suggests some interesting features, which are well shown in the accompanying map, in the preparation of which I have used the report of the State Board of Health of New Jersey for the year ending June 30, 1897; an excellent system of registration making it possible to give a correct idea of the distribution of this disease throughout the State. As I have previously shown for the States of Pennsylvania and New York, wide variations are present in different regions of the State, but the various degrees of prevalence of tuberculous disease correspond in great measure with well-known facts relating to tuberculosis.

In New Jersey there are not such wide variations in the frequency of tuberculous disease in proportion to population, as compared with New York and Pennsylvania, in which States there are counties in which the disease is three or four times as rare as in more densely populated districts. In New Jersey the counties in which the larger cities are situated show a prevalence only twice as great as in the sparsely settled regions. It will be noted that Hudson, Essex, and Mercer counties, in which are situated Jersey City, Newark, and Trenton, have from 400 to 500 persons living for every death from pulmonary tuberculosis, while Sussex, Warren, Hunterdon, and Gloucester counties have between 800 and 900 persons living for every death annually from the same disease.[1]

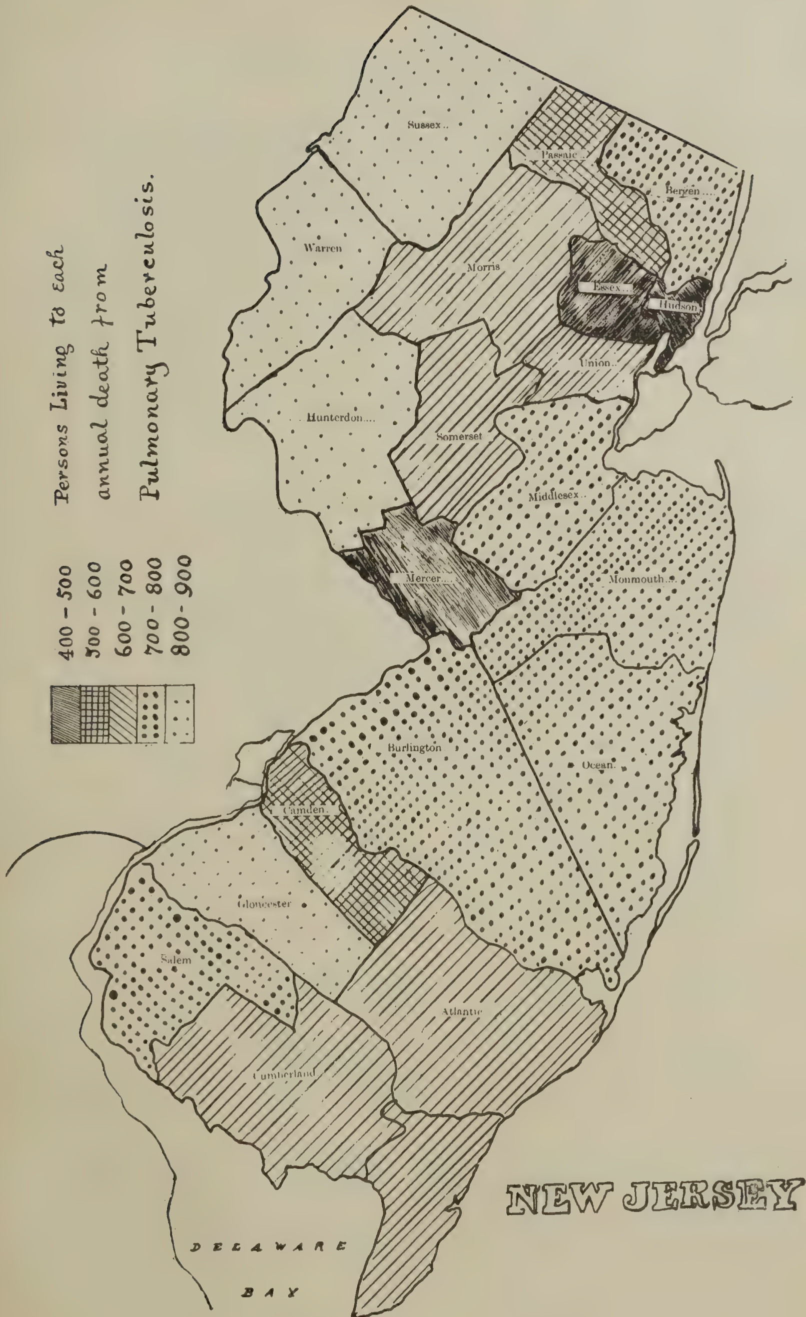
[1] It should be stated here that, by the returns for the year ending June 30, 1898, three counties, by a largely diminished death-rate, take precedence of any of the

The remaining counties are platted to show the three intermediate grades. The reasons for this variation may be accounted for as follows: In the first place, elevation above tide does not play a part, as it apparently does so plainly in the case of Pennsylvania. In New Jersey, on the other hand, we find that one of the counties, Gloucester, in South Jersey, is quite low, but it belongs to the group in which tuberculosis is least frequent. It is at least as low as the three counties in which the disease is most prevalent. Neither are there any natural protecting influences, such as forests, which influence the distribution of the disease in this State. The entire southern half of New Jersey is flat and abounds in vast tracts of pine-forest, but we find it principally a variety of hard, yellow pine known as scrub-pine and scrub-oak and not the great forest trees met with in the highlands of Pennsylvania and New York. In the northern and northwestern parts of New Jersey the surface is more diversified and even mountainous, reaching elevations of nearly 1800 feet, and the hillsides abound in hemlock and spruce. The soil in the northern half of New Jersey is largely a red clay, with outcroppings of sandstone and, in the northeastern portions, trap-rock. In Essex County there are positive evidences of a great prehistoric lake called Lake Passaic. Its southern portion is the present site of a great swamp. The soil of the southern half of the State, or at least south of the latitude of Camden, is principally sand. which reaches, in places, such as Lakewood, to a depth of 600 or 700 feet. But the character of the soil would seem to have little, if any, influence in the present instance in modifying the presence and distribution of tuberculosis.

It is *density of population* that bears the closest relation to the distribution of tuberculosis in New Jersey. This is true in all communities, and it is well borne out in the present instance. The accompanying chart shows this graphically. The counties that have less than one acre to each inhabitant are Hudson,

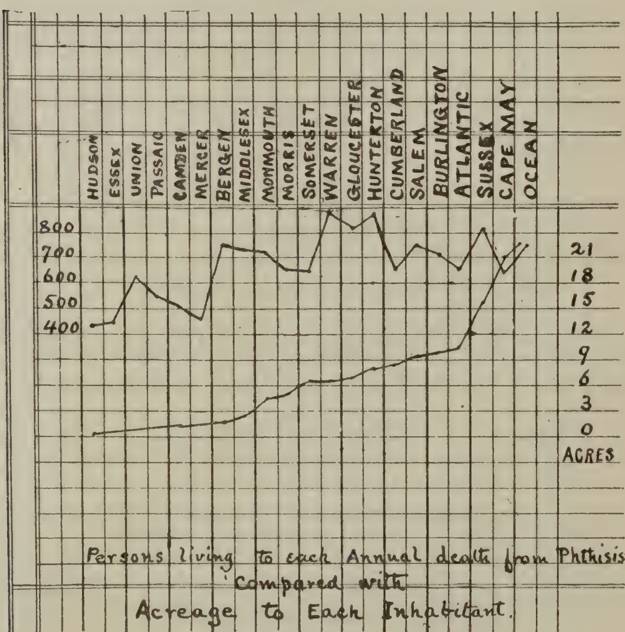
counties in the above-mentioned group. These are Cape May, Monmouth, and Somerset counties, and for the year just closed they each have over 1000 persons living for every annual death from pulmonary tuberculosis.

FIG. 1.


Persons Living to each
annual death from
Pulmonary Tuberculosis.
400 - 500
500 - 600
600 - 700
700 - 800
800 - 900
Sussex
Passaic
Bergen
Warren
Morris
Essex
Hudson
Union
Hunterdon
Somerset
Middlesex
Mercer
Monmouth
Burlington
Ocean
Camden
Gloucester
Salem
Atlantic
Cumberland
NEW JERSEY
DELAWARE
BAY

Essex, Union, and Passaic. These all have a high death-rate from tuberculosis. On the other hand, Atlantic, Sussex, Cape May, Monmouth, and Ocean counties have a low death-rate. Four of these are maritime counties. Sussex is the furthest removed from the sea and embraces the highest land in the State. It adjoins Pike County in Pennsylvania, one of the wildest and one of the most healthful counties in that Commonwealth. The three counties, Sussex, Warren, and Hunterdon, are all inland counties, comprising high, well-drained territory not closely settled and embracing the most picturesque portion of the State.

FIG. 2.



In Mercer County, in which is situated the capital of New Jersey, the death-rate from tuberculosis is found to be twice as great among men as among women. Investigation shows that the men work in the potteries of Trenton. If it were not

for the potteries in this district perhaps the results from Mercer County might be a little better.

The causation of pulmonary diseases among potters in the city of Trenton has received some attention, and in an article on this subject, the late Dr. E. M. Hunt (1883) said:

"All the facts as to the perils of this industry point to impalpable dust, constrained positions, and sudden alternations of heat and cold, as the causes of shortened lives and of pulmonary diseases so common as to have made the potters' asthma a designation for a class of chronic ailments which kill many and are life-long to many more. These causes, so far, admit of removal or amelioration, and are so destructive in their character that the means of proper cleansing, ventilation, and heating, the management of dust, and the details of method, should be closely inquired into. In no department in our State is there more need of close inspection and of such law as will relieve this skilful working-class from evils alike destructive of life, of health, and of prosperity."

It is unfortunate, on some accounts, that travellers through New Jersey do not, as a rule, see a more attractive landscape. They generally pass through a flat, uninteresting country. Few visit the hills in the northern and northwestern portions, and these undeveloped districts, if more accessible to the larger cities, would no doubt be highly prized and largely sought.

It is encouraging to note that pulmonary tuberculosis is diminishing in New Jersey, just as it is declining in neighboring communities. The number of deaths for the year ending June 30, 1897, was 3237, which was 121 less than the previous year, and 255 less than the average for the ten years 1887–1896.[1]

The health authorities of New Jersey are keenly alive to the necessity of informing the public as to the means by which

[1] The total number of deaths from pulmonary tuberculosis for the year ending June 30, 1898, is 3225, a further reduction. A recent communication from Dr. Henry Mitchell, Secretary of the State Board of Health of New Jersey, shows that the counties in which an actual reduction has been noted are Atlantic, Bergen, Camden, Cape May, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Somerset, and Warren, a majority of the counties in the State.

the disease is propagated and the best methods of prevention. The early recognition of the disease will greatly aid one's chances of recovery, but a little money expended by the State in prevention is better than hundreds of thousands of dollars spent in cure. Circular No. 83, of the New Jersey State Board of Health, has been ordered to be placed in the hands of every family in the State in which a case of tuberculosis exists. Dr. Henry Mitchell, the secretary, has distributed many thousands of these circulars, which explain the cause and means of communicability. Practical information is given as to the location and construction of houses; the quality of food; the disposition of sputa; the cleansing and disinfection of carpets and rooms.

Counties in New Jersey.	Population in 1897.	Deaths from pulmonary tuberculosis.	Persons living to each annual death from pulmonary tuberculosis.	Acreage to each inhabitant.
Atlantic	37,114	56	663	10.6
Bergen	72,461	95	762	2.1
Burlington	60,061	85	706	9.5
Camden	105,070	206	501	1.4
Cape May	13,489	21	642	21.0
Cumberland	51,555	77	669	8.5
Essex	334,000	739	452	0.25
Gloucester	32,207	40	805	6.7
Hudson	349,260	812	430	0.11
Hunterdon	35,334	40	883	7.9
Mercer	87,762	185	474	1.6
Middlesex	73,378	101	733	2.8
Monmouth	78,109	108	714	4.4
Morris	61,710	92	671	5.0
Ocean	19,135	25	765	22.6
Passaic	144,499	262	551	0.9
Salem	26,456	35	756	9.4
Somerset	31,301	47	666	6.2
Sussex	22,596	23	982	15.6
Union	90,578	146	620	0.7
Warren	37,575	42	894	6.2

DISCUSSION.

Dr. J. B. Walker: I would like to ask Dr. Hinsdale if the comparative absence of disease in Gloucester County may not be accounted for in part by the comparative wealth of the farmers living in the section. It is largely the vegetable garden for Philadelphia, and on

this account its people have comfortable homes and abundant food supply. Then the topography of the country and its soil are favorable. Though bordering on the river, most of it is rolling land, which, with its sandy soil, places it at an advantage.

Dr. Charles E. Quimby: One lesson that may be drawn from the paper is that health-resort places are not necessarily elevated. The outlines of a town do not fix the place where a man may go for recovery. I have that impressed upon me in sending patients away who are unable to go to the more expensive places. They ask if there are no other places. If you suggest a town that is adjacent to a well-known health resort there is a great deal of hesitancy in accepting it. I think these suggestions show definitely that we may find all through the region of New York and Pennsylvania abundant health resorts where we may send patients and avoid the disadvantages of aggregating large numbers at any one point. I hope we shall come very soon to scattering them about and not getting them all grouped at one spot.

Dr. Glentworth R. Butler: I simply wish to express my appreciation of such studies. I know they require an immense amount of work and careful investigation, and I consider them extremely valuable. Many of our Brooklyn people go to New Jersey in the summer, because of the great advantage of being near to the business centres of New York and Brooklyn. I have been instrumental in sending a number of people to the northwestern part of the State whenever possible, rather than to other parts, for the reason advocated by Dr. Hinsdale, because it was adjoining to the mountainous and healthful districts of Pennsylvania. It is a pleasure to have this opinion confirmed by this careful study of Dr. Hinsdale.

DEFINITE RECORDS OF PHYSICAL SIGNS.

By CHARLES E. QUIMBY, M.D.,
NEW YORK.

THIS latter half of the nineteenth century has come to be known, no less in medicine than in other branches of science, as the "age of precision." To that characteristic are attributed the wonderful developments along practical lines in all directions. So great, however, has been the enthusiasm over cash results that often novelty of application has come to be regarded as the discovery of a new law of nature, until ingenious mechanics are considered mechanical geniuses. Yet we, as physicians, may rejoice with peculiar satisfaction that in medicine the change has not been solely one of technique and application, but that, in many lines at least, we have started *de novo*, and, for the first time, upon a strictly scientific basis.

While surgery may, perhaps, present to the layman the most obtrusively attractive illustrations of exactitude in methods and results, the more critical and closely analytical professional mind must admit that the broadest and most potentially valuable advances in medical science of our own time have been in the domain of pure medicine. Within the memory almost of the youngest, fever has been transformed from a raging demon to be exorcised by prayers and mercurial incense, to the patron saint of all bacterially besieged bodies, who lights the fiery furnaces only that the invading hordes may be consumed. The old "tumor et rubor" of inflammation have become the tent and crimson banner of a surging army rushing to the defence of their country. And pathology itself retains its

name only as a more convenient term than special physiology. Yet it is these selfsame delights of an expanding science which add venom to the sting of chagrin we experience at finding that, in one branch of our work, which of all others should be scientific, the ostentatiously displayed insignia of exactitude but cloak the wildest confusion. The very name physical diagnosis presupposes definiteness and certainty, claiming, as it does, for a basis the best developed of allied sciences. From its inception it has appropriated the terms of that science, and used them with a boldness which, in the light of facts, is seen to be far from justifiable. For to-day among the horde of indefinite terms we employ with an abandon eminently befitting their elastic significance, none convey to our minds more vague impressions than the names we use to designate physical signs. This fact becomes painfully apparent when we attempt to convey to some other mind our own auditory impressions of the sounds derived from any given chest. The sharp-cut, crystallized terms of acoustics we find have become dissolved in the acids of mental fermentation. Dulness means any departure from normal lung to liver percussion, while even the broad monotony of flatness is not devoid of variations.

But, if there are mists hanging over percussion, they deepen to a London fog about auscultatory signs. One work on physical diagnosis, that for years has been an unquestioned authority, states that "rude respiration embraces every degree of modification between vesicular and bronchial breathing." Under the stimulus of the natural dissatisfaction resulting from this condition of things, the purpose of this paper is to outline some modest attempts at recrystallization and to urge the adoption of a scientifically accurate method of recording the results of physical examinations of the lungs. That it is possible to make such a record, and in such manner as will render it a direct index of the amount of disease and a standard for future reference, I am fully convinced. Mensuration is already exact. We consider, then, percussion and auscultation as at present indefinite.

Of the four recognized elements of sound, pitch and quality

alone are inherent. Intensity and duration are essentially quantitative elements of the other two. Of these, pitch alone is determinable without the aid of complicated apparatus, and hence is the only element affording a basis for sound records. Fortunately it is the fundamental element depending solely upon the physical constitution of the sonorous body, and is the only one not affected in transmission of sonorous vibrations, and has for ages been the subject of record.

In an article on the "Applied Physics of Physical Diagnosis," published some years since, I demonstrated that percussion sound as a whole is a compound sound, made up of two terms, each of which is a distinct sound of essentially independent origin: the one coming from the vibrating chest-wall, as modified by contiguous solid tissues, and the other being the contingent resonance in the pulmonary air-spaces. I also showed that this latter term, properly called pulmonary resonance, never changes in pitch, but only in volume, through all the changes of pulmonary consolidation; and, hence, that any absolute variation in pitch of percussion sound must come from the thoracic term. It is unnecessary, however, at this time to enter upon a strictly physical analysis of percussion sound; for, while the two terms of that sound may usually be separated by a trained ear, or by any one in cases of well-developed emphysema, and heard independent of each other, the sonorous sum of these terms is, nevertheless, readily appreciated as a single sound in which we recognize variations by something that is the equivalent of pitch to our ears. Since then, sound is purely a sensory impression, the clinical value of that element which we recognize by pitch is no different, whether it depends upon absolute change of pitch in one term, or upon volume ratios between the two terms, provided, always, that such variations maintain some constant relations to physical changes in, or within, the thorax. Certainly no proof can be demanded of the proposition that percussion sounds do possess appreciable pitch, and that this pitch is affected by changes in the thoracic tissues, for it is the accepted basis of all our physical diagnosis. Such a proposition is essentially affirmed in

all works on the subject, and it is assumed, if not stated, that these changes of pitch maintain a constant, or at least uniformly varying, ratio with the tissue changes. Therefore, unless the entire medical profession is in error and physical diagnosis a pitiful delusion, pitch of percussion and respiratory sounds is a definite index of physical conditions and of pathic processes; and a record of pitch variations in these sounds is an equally definite and absolute record of changes in such conditions and processes. With these propositions granted, demonstration of our claim becomes simply quotation of established physical laws.

The term pitch implies something definite which may be definitely determined. Being determined it may be measured by a standard and its value fixed in accordance with the laws of acoustics. Acoustics already has its nomenclature by which such values are recorded, as a, b, c, etc., of the scale. Hence this necessary conclusion: The pitch of percussion and respiratory sounds can be recorded in acoustic notation; and this corollary: Physical conditions and their variations under pathic processes can be definitely indicated in the form of permanent records.

The foregoing statements, which demonstrate the possibilities in this direction, also clearly reveal where the difficulties will be found in the clinical application of acoustical laws for the production of such records. These difficulties will be: 1. The recognition of pitch in impure physical sounds and its apprehension with such certainty that its value may be established; 2. The determination of a standard for measuring pitch values; 3. Obtaining these values in acoustic terms by comparison.

A little care and practice, however, with even the most moderate musical skill, will enable one to surmount them.

1. *The recognition of pitch in thoracic sounds.* Ninety-nine out of a hundred physicians at first will probably affirm they can never do it. But I venture to say that not one out of five hundred whose skill would fully justify them in resenting any questioning of their ability to recognize minute variations in percussion and respiratory sounds, and who would

claim rightly that they do it from the pitch of those sounds, has ever taken a single such sound and attempted to determine and fix its pitch to the point of being able to sing or whistle a tone of the same pitch, although they have been talking of pitch in these sounds all their professional lives. Yet that is easily done by any one—so easily that he who tries will blush at recognizing how lowly he has estimated his own ability. In nearly ten years of teaching physical diagnosis by this method among several hundred students, I never found half a dozen who could not do it with ten minutes' illustration and an hour's practice. A trained musical ear will do it the first time with accuracy. Having obtained this pitch-note in a tone where it can be held, one has but to compare it with the note from a standard tuning-fork to fix its position in the musical scale and define its letter of record. To do this with certainty and accuracy may require longer practice, yet almost no one will find it impossible; to most it will be simple.

2. *The standard note*, and 3. *Its use.* The physician possessed of some musical training will soon find himself using the tuning-fork as his standard of comparison. This, however, is not so much a matter of necessity or, indeed, so desirable as at first thought it might seem. For it is impossible to fix, *a priori*, any note as representing normal in even a single chest, much less for all. Moreover, such a record might prove valueless as a standard of comparison for some other physician of less skill, whom the patient desired to consult later, although that physician might be able to obtain an equally definite comparative record. Since, then, it practically never happens that all of both lungs are diseased in a given case, these records lose little or nothing in immediate value or significance but are made more widely available if the standard notes are taken for both percussion and auscultation from some unaffected point in the chest. This method, too, will be found safer and less difficult by those whose appreciation of musical tones is undeveloped, since it implies only sufficient skill to whistle the scale. It is made still simpler by limiting the comparison to corresponding points on the two sides. Having determined the pitch of

these points, the lower one can be taken as "do," and then one has but to run up the scale until the other is reached to fix its relative position. In case both points represent diseased areas, a further comparison must then be made of each with some point representing unaffected tissues. It will be seen that in this method failure to recognize pitch at its true musical value does not detract from the value of results, provided the ratios be correct.

It hardly seems necessary to repeat the demonstration in relation to respiratory sounds, as the application is self-evident. One or two clinical points, however, require notice. It has always been assumed that variations in pitch of respiratory sounds maintained a constant, or, at least, uniformly varying ratio with the causative tissue changes. A very brief study of these sounds, however, by this method will show that such is not the case. On the contrary, not only are the changes of inspiration and expiration, separately, far from regular or uniformly proportionate to tissue changes, and different for each; but inspiration, under certain conditions, becomes separated into two sounds of different and distinct pitch. In any case inspiration changes more rapidly than expiration, and this change is greater with the early and slighter grades of consolidation than with the more complete degrees. We thus find pitch losing in significance at just the point where we naturally expect to find it the most valuable. This disadvantage is offset, however, to a large degree by the addition of rhythm to the elements susceptible of definite record. As a further aid we have here the note of tracheal respiration, representing the lowest-pitched possible respiratory sound as a fixed standard for all comparisons, and from which the absolute pitch of respiratory sounds acquires a peculiar significance. Thus, our comparisons here are not only local between inspiration and expiration, but also with a significant standard. All together, then, taking the higher of the two sounds when inspiration is double, we have the basis for very satisfactory and valuable records. A complete physical record of respiration at any given point thus comprises: 1, the pitch note of the trachea; 2, that of inspira-

tion and expiration; and 3, the relative length of these two sounds expressed as a fraction. For example: Respiration at point *a*, left chest. Tracheal note g; inspiration f above; expiration c between; rhythm $\frac{3}{4}$. It is understood that the foregoing statements refer solely to respiratory sounds as affected by uniform changes in the chest, and exclude localized excavations, although the same principles may be applied to these conditions. Thus respiratory with percussion sounds afford an absolutely scientific, accurate record of pulmonary conditions and changes. It would be superfluous to dilate upon the value of such records, either in cases remaining under our own supervision or for such as we desire to send to other climates and place in the care of other physicians.

VARIATIONS IN PATHOGENIC ACTIVITY AMONG TUBERCLE BACILLI.

By THEOBALD SMITH, M.D.,
BOSTON.

In the production of states of disease due to infection we should recognize two main modifying factors: the pathogenic activity or virulence of the infecting organism, and the resistance[1] of the infected individual.

Variations in the pathogenic power of bacteria are probably the result of prolonged sojourn in slightly different environments. If, for instance, a given tubercle bacillus had successfully invaded a vigorous adult, and had successfully passed from this person to a second, a third, or a long series of vigorous adults, and had then, after this prolonged contact with tissues of a certain vitality, invaded the body of a child, we are justified in assuming that the virulence of this bacillus with reference to the child has been increased by its successful invasion of vigorous, naturally more resistant, adults. Again, if a tubercle bacillus vegetating in a tuberculous lesion of the skin, through a favorable combination of accidents, had produced a series of infections of the skin, we may assume that differences, however slight, between this bacillus and one infecting a series of lungs would become eventually established. A continuation of such series, through fortuitous circumstances, might finally produce two varieties of tubercle bacilli, each incapable of taking the other's place successfully. It is probably in some such way as this that varieties are produced which become restricted as to the territory they are capable of infecting, while at the same time they become especially adapted to infect this restricted territory. The bacillus of bovine tuber-

[1] This term figures in medical writings chiefly as immunity, although the term is merely relative, since there is no absolute immunity.

culosis illustrates another phase of the same problem. Does it by its continued passage through the bovine body become more virulent to human beings, or does it thereby lose largely its power to graft itself upon the human system? Either alternative may be true, but neither is proved.

I cite these illustrations to emphasize the relativity of the term virulence and its dependence on the character of the host, as well as the relativity of the term resistance as it depends more or less on the bacterium. These two terms—virulence and resistance—may be compared to the two opposite sides of the same shield. They are, as mathematicians would say, functions of one another. They are, however, none the less real when we come to deal with given species, races, or types of individuals whom the tubercle bacillus may infect. It takes a long time to modify bacteria, and for the short space of life of the individual their characters are practically fixed. We need here a certain sense of perspective to enable us to appreciate the slow change during long periods of time and the temporary fixity. The evolution of new characters is going on in all living organisms, but all our information concerning them is anchored, as it were, to their temporary stability.

In the laboratory we are able to modify, experimentally, both the virulence of certain bacteria and the resistance of the host. By passing these bacteria through a long series of susceptible animals of the same species a greatly increased potency of the bacteria with reference to that species is noticed at the end. By treating susceptible animals with certain bacterial products or cultures killed by heat or chloroform the resistance may be increased. Different degrees of induced resistance lead to different clinical and pathological types of the same inoculation disease, so that the etiological relationship between them would hardly be surmised without a definite knowledge of the experimental details.[1]

[1] I have expressed this relationship between the type of disease, on the one hand, and the virulence and resistance, on the other, by the simple equation $d = \frac{v}{r}$, where v = virulence, r = resistance. Increasing v or diminishing r, we augment the severity of the disease d. Increasing r or diminishing v, we diminish its severity.

Variations in the pathogenic activity have been demonstrated for a considerable number of disease-producing species. In fact, it seems to be the rule to encounter slight variations in the study of series of cultures of the same organism obtained from different sources. I might cite many illustrations in support of these statements, but I shall limit myself to one of general interest. The diphtheria bacillus, which is so well characterized by the production of a specific toxin, may vary in the power to produce this toxin from case to case. Thus bacilli from one source have produced for years just three times the amount of toxin produced by bacilli from another source when cultivated in bouillon of the same composition. Other numerical relations in the power of toxin production may be cited, but the fact I wish to emphasize is the constancy of the variation under identical conditions.

In their contact with infectious diseases physicians have laid the emphasis now on virulence, now on resistance. With diseases having a rapid course, like cholera, the plague, and diphtheria, the relative resistance of individuals is in the background and the virulence of the infecting agent receives more attention. With diseases of slow progress, like tuberculosis, attention is centred upon the resisting capacity of the individual, as expressed by heredity, bodily conformation, and environment—the soil, in other words, of which we have heard so much. It may be that the instinct of the experienced physician is quite correct in attributing to the resisting capacity of the individual in the more prolonged chronic infections a more conspicuous influence than in the acute infections. Certainly we are not prepared to-day to deny it. Of these two conceptions—virulence and resistance—I shall confine my remarks to the most neglected one, not for the purpose of bringing to light startling hypotheses or unlooked-for facts, but to call attention to virulence as an element not to be ignored in our study of tuberculosis.

Variations in pathogenic activity among bacteria specifically related may be due to artificial cultivation or they may be found spontaneously, and they are then due to a natural culti-

vation in the human or animal body through long periods of time. There are on record some statements concerning the weakening or attenuation of the tubercle bacillus after prolonged artificial cultivation, which I may pass over here, as it is the fate of all bacteria to become reduced in virulence in this way. There are also some statements concerning artificial attenuation with disinfectants like iodoform. These do not bear on the main question before us, which is concerned with the discovery of varieties of tubercle bacilli as they actually occur in the diseased body. These may be found infecting different species of animals, or they may be looked for in individuals of the same species. These distinctions will be better understood if we glance for a moment over the large field occupied by this formidable organism.

It is now a widely-known fact that besides man the lower animals are the victims of tuberculosis. Tuberculosis of cattle is a widespread evil, increasing year by year. Through the food products derived from cattle swine have become extensively infected in some countries. Carnivora, and especially monkeys, contract it. It is rarely found in horses. Poultry in European countries is subject to it. Maffucci has shown that the bacillus producing tuberculosis in fowls has certain characters which distinguish it from the human bacillus, and which give it the rank of a variety or race. Investigations which I have been carrying on during the past three years have revealed certain constant differences between bacilli obtained from human sputum and those from cattle sufficient, in my estimation, to make the bovine bacillus a race by itself.[1] It is probable that the tubercle bacillus has become modified through a long series of transfers from one animal to another of the same species into a number of varieties which may be considered more or less adapted to their respective hosts, but whose relation to other hosts is at present obscure. The relation, for instance, in which the bovine tubercle bacillus stands to the human race is of the utmost importance in view of the

[1] The Journal of Experimental Medicine, 1898, vol. iii. No. 4.

wide dissemination of this disease and the difficulties encountered in coping with it. Passing to the disease as it is found in the human subject we are confronted by the problem of variation in a narrower sense. It is evident that differences in pathogenic power are much less likely to become evolved in bacteria which are parasitic upon individuals of the same species because of a close uniformity of soil, and if they occur at all the differences are probably less appreciable than those occurring in different species.

In weighing the probabilities in favor of the existence of varieties among human tubercle bacilli we find a strong argument in the wide divergence of occupation and environment into which the life of the human race has become differentiated. This is not so with domestic animals—cattle, for example—which, with slight variations in food and the amount of indoor confinement, are doomed to the same monotonous existence. In the human race the great differences in the condition of individuals have provided for infectious agents a variety of soils in which to vegetate. If, through chance, several given bacilli should invade series of the different types of individuals slight differences in the bacilli might eventually be looked for. Such differences may, however, be too slight to be apprehended with our present crude methods. In the paper referred to above I called attention to the probable modifying influence upon the tubercle bacillus of a prolonged multiplication in the necrotic material and the bronchial exudation in cases of mild, long-standing pulmonary tuberculosis. Here a contact with living tissue endowed with bactericidal properties does not occur, and the tubercle bacilli live a saprophytic existence which must sooner or later modify their aggressiveness toward living tissue. Speculations and hypotheses are, however, of little value, often positively injurious unless in part supported by demonstrable facts. Hence they must be tested by experiment upon animals and observation of animal diseases in which secondary influences are less numerous and preponderant than in man. The broader and more varied these experiments and observations are the safer the conclusions when applied to human diseases.

A survey of the field of experimental medicine shows that but little has been as yet accomplished in the study of variations of the tubercle bacillus, mainly because it seems to have been taken for granted that varieties do not exist. In his investigations upon the new tuberculin Koch[1] had occasion to have a number of cultures studied by his assistants, and in his report he briefly states that there was considerable variation in the virulence. To Arloing, of Lyons, belongs the credit of having called attention to this subject more than ten years ago. He and his pupils have been experimenting with the products of various forms of tuberculosis in man, and, as a result of their experiments, they claim that with rare exceptions the bacilli of pulmonary tuberculosis are more virulent than those of the scrofulous or surgical forms of tuberculosis.[2] Arloing bases his claim upon the fact that bacilli from visceral tuberculosis are much more pathogenic toward rabbits than those of the scrofulous forms. When, according to this author, bits of tuberculous tissue or sputum are placed in the subcutaneous tissue of the thigh of rabbits, these from the pulmonary disease invade the lungs of rabbits, where tubercle may be detected after two months. Those from the other types of tuberculosis fail to reach the lungs, and remain localized. In guinea-pigs both produce eventually a generalized disease. In a recent paper Courmont and Denis,[3] two of Arloing's pupils, continuing his work, have shown that the pulmonary form of tuberculosis may now and then harbor quite attenuated bacilli.

Arloing has encountered considerable opposition, mainly because the method he employed is not above criticism. It is a well-known fact that the course of the disease artificially induced in animals with tubercle bacilli depends largely upon the number of bacilli introduced. Inasmuch as they greatly vary in number in different lesions, and as the staining does not tell us whether they are living or dead, the inoculation of the products of disease is a rather uncertain factor upon which to base

[1] Deutsche med. Wochenschr., 1897, No. 14.

[2] Leçons sur la tuberculose et certaines septicémies. Paris, 1892.

[3] "De la tuberculose pulmonaire à bacilles atténués." Rev. de la tuberculose, 1897, v. p. 289.

conclusions. In order to test Arloing's work, Auclair[1] recently undertook, under Grancher's supervision, the study of cultures from four cases of tuberculosis, a rapidly progressive tuberculosis of a gland of the neck, and a case each of true scrofula, slow phthisis, and acute meningitis. On guinea-pigs the intra-abdominal injection of the cultures had nearly the same effect. Hence the author does not hesitate to regard them as identical in virulence. Auclair, in failing to test the cultures upon rabbits, did not improve much upon the method of Arloing, for with the aid of these animals we are enabled to determine degrees of virulence not recognizable in the very susceptible guinea-pig. The views of Arloing are, therefore, still to be disproved. They are, however, quite in harmony with facts obtained experimentally with other pathogenic bacteria to which I have already referred. It is quite impossible, from our present stand-point, to consider the great variations in the localization of the tubercular virus and in the course taken by it in the human body as merely fortuitous. Undoubtedly the factors of virulence and resistance play a prominent part. We are in a much better position to-day to undertake investigations into the relative virulence of tubercle bacilli from different sources than into the much more complex factor of resistance to their invasion and multiplication. Any light thrown on the subject of virulence will indirectly illumine that of resistance or susceptibility.

My own studies of human tubercle bacilli, though somewhat limited in range, lead me to believe in the existence of minor variations in the form of the bacillus, the appearance and character of the cultures, and the virulence, whose significance need still to be deciphered. Among seven cultures of bacilli from sputum one differed from all the rest in refusing to grow satisfactorily upon dog's serum. Of other forms of this disease only one culture has been under observation. The patient, sixty-five years old, had a large swelling on the left side of the neck, which broke and discharged much pus. It continued

[1] "Recherches sur la virulence des bacilles tuberculeux humains provenant de sources cliniques diverses." Arch. de méd. exp., 1897, ix. p. 1124.

discharging through sinuses until death, which took place about five months after the appearance of the swelling. When first seen by the pathologists of the Boston City Hospital, to whom I am indebted for the material, the discharge contained a very large number of bacilli. It was supposed that these were of more than the average virulence; but the cultures which I obtained through guinea-pigs proved rather the opposite. They were less virulent than the sputum cultures studied both toward rabbits and guinea-pigs. This case illustrates the uncertainty of our deductions when the pathogenic agent is not studied independently of the many modifying influences at work in the human body.

It would be presumptuous on my part to dilate upon the practical value of a more accurate knowledge of tubercle bacilli. Those who are engaged in pathological, etiological, and therapeutic studies of tuberculosis will promptly discern how such information will serve their special purposes. To the student of etiology the search for the bovine variety of the tubercle bacillus in the human body will for a time be the most important problem. To the pathologist the variation in the lesions produced by the tubercle bacillus will need renewed study by comparing the bacilli which are responsible for divergent tissue changes. The physician will desire better information upon the possible differences between bacilli producing tuberculosis of the integuments, of the bones and joints, and of the viscera. He will wish to know any demonstrable differences between a rapidly fatal case and one that is protracted over years. He will, above all, wish to interpret his therapeutic successes and failures.

The outcome of studies of the pathogenic power of tubercle bacilli upon animals must, however, not be taken too literally. It should be borne in mind that results are at best only comparative. Thus increased virulence toward certain species of animals as tested in the laboratory must not be interpreted to mean necessarily increased virulence toward the human organism, although this may eventually be proved to be the case. The only positive information we may safely accept are the

accurately ascertained degrees of difference among tubercle bacilli from different sources as expressed in terms of bacteriology. Thus I have calculated approximately that the virulence of sputum bacilli to bovine bacilli is as 1 to 20, or 1 to 30 when tested on rabbits. No one will venture to assert, with these figures in mind, that when these races are implanted in the human body this great difference will be wiped out and the resulting disease be the same. Such differences signify certain unknown differences in behavior in the human body which must be studied by the clinician and the pathologist before they can become available as positive knowledge.

INFECTION FROM THE HANDS IN PHTHISIS.

By E. R. BALDWIN, M.D.,
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It should not occasion surprise that tubercle bacilli can be found upon the hands of patients in the advanced stages of tuberculosis. I use the term "phthisis" in this sense, for we hardly need to consider the early stages where the expectoration is usually slight.

In reviewing the abundant literature on different modes of infection in tuberculosis, scant mention is made of soiled hands as one carrier of the germ. Nor is this strange when the overwhelming importance of inhalation has been so emphasized. It is safe to say that the danger from a few bacilli on the fingers is very slight, or it would have demanded attention ere this, and I am aware that it is difficult to mention this subject without danger of exaggeration. Neither do I pose as the exponent of a new terror from microbes. As for that, it would be easy to conceive of infections of all the diseases in this category conveyed on the dirty hands of some people. Fortunately for the race, disease is not a question of infection alone. Therefore it was not so much with the expectation of determining the degree of danger from the hands that the following experiments were undertaken, as to note the differences in respect to the presence of bacilli between otherwise cleanly persons using handkerchiefs and those depositing their sputum on cloths or in cuspidors.

As opportunity offered during the past year or more, I have washed the fingers of ten private and eighteen sanitarium*

* Adirondack Cottage Sanitarium.

patients, all of whom were known to have expectoration containing bacilli. Two of the private patients were bed-ridden. All the others were ambulant, those from the sanitarium being generally in better condition than the private patients. Fully one-half of the private patients were using cuspidors and occasionally their handkerchiefs. The rest used either cuspidors only or with cloths. Two used handkerchiefs only, and those of the finest fabric. The sanitarium patients uniformly denied using handkerchiefs. In no case was an intimation given of the object of the experiment before it occurred, as it might have induced some to defeat the purpose of the test by an abnormally careful toilet. This was especially guarded against in the sanitarium patients by calling them together without previous notice, and by private examination. The patients had washed their hands before the test washing, in periods varying from ten minutes to twelve hours. The following technic was used:

Carefully cleansed, sterilized, plain glass finger-bowels with glass covers were used to catch 5 to 10 c.c. sterilized 0.1 per cent. Na_2CO_3 solution, which was poured between the palmar surfaces of the fingers while the patient rubbed them together in the bowl. The alkali was used to render the solution slightly soapy. Separate bowls were used for each patient.* Two small guinea-pigs were then used for inoculation with the washings of each private and five of the sanitarium patients. The others were simply examined microscopically for tubercle bacilli. One pig in each experiment was inoculated with 0.5 c.c. in the peritoneum, together with an equal quantity subcutaneously in the right groin, while the other received 0.5 c.c. in each groin. The Koch syringe used for all inoculations was boiled in alkaline solution before use. The remaining wash water was centrifugated in clean, well-burned glass tubes, and the sediment examined for tubercle bacilli.

* The work was carried out at the Saranac Laboratory.

Table I.—Ten Private Patients.

Date.	Name.	Occupation.	Habits and appearance.	Condition of disease.	Relative No. T. B. in sputum	Am't of sputum	Receptacle used for sputum.	Hour of last wash	Hour of test wash.	T. B. in centrif. sedim't.	Weight of pigs. 1	Weight of pigs. 2	Result of inoculat'n 1, periton. and groin	Result of inoculat'n 2, groin only.
1897											gm.	gm.		
May 26	Miss B.	Music student.	Apparently clean.	Pulm. tuberc., chron.; cavity; ambulant.	Moderate.	Profuse	Handkerchief only.	6 A.M.	9 A.M.	Not exam.	...	...	*46 days	*68 days
July 11	Miss C.	School-teacher.	Apparently clean.	Pulm. tuberc., chron.; cavity; ambulant.	Few	Moderate.	Handkerchief only.	7 P.M.	8 P.M.	Not exam.	275	270	*46 days‡	*73 days
Aug. 27	Mr. F.	Merch'nt	Not cleanly.	Pulm. & intest. tuberc., chronic.; ambulant.	Numerous.	Moderate.	Cuspidor and handkerchief.	9 A.M.	11 A.M.	Few	300	290	*39 days‡	*84 days
Aug. 31	Mrs. T.	Housekeeper.	Scrupulously clean.	Advanced pulmon., intest. and laryng. tuberc.; bed-ridden.	Numerous.	Moderate.	Linen cloth roll.	9 A.M.	11 A.M.	None.	305	328	† septicæmia 28 days	†91 days‡
Sept. 27	Mr. W.	Student.	Cleanly.	Acute pulm. tuberc.; cavity; bed-ridden.	Very numerous.	Profuse	Cuspidor and cloth.	9.30 A.M.	10.30 A.M.	Not exam.	440	405	*43 days‡	*8½ mos.
Nov. 18	Mr. D.	Teacher.	Cleanly.	Pulm. & intest. tuberc.; cavity; ambulant.	Fair numb'r	Profuse	Cuspidor; handkerchief rarely.	1 P.M.	5 P.M.	Numerous.	300	320	*55 days‡	*57 days‡
Nov. 22	Mrs. D.	Housekeeper.	Cleanly.	Pulmon., intest. and laryng. tuberc.; bed-ridden.	Fair numb'r	Profuse	Cuspidor and absorbent gauze.	7.30 P.M.	7 A.M.	Numerous.	200	270	*56 days	*54 days
Dec. 7	Miss F.	Housekeeper.	Very clean.	Pulm. tuberc., chron.; cavity; bed-ridden.	Not noted.	Profuse	Cuspidor and handkerchief.	9 A.M.	5 P.M.	None.	215	215	†8 mos.‡	*133 days
Dec. 7	Mrs. R.	Housekeeper.	Very clean.	Pulm. tuberc., chron.; cavity; ambulant.	Fair numb'r	Slight of pus.	Cuspidor only.	2.30 P.M.	2.40 P.M.	None.	245	235	66th day negative tuberculin test.†	
Dec. 9	Mr. A.	Engineer.	Quite cleanly.	Pulm. tuberc., chron.; cavity; bed-ridden.	Very few.	Profuse	Cuspidor & cloth.	8 A.M.	6 P.M.	Not exam.	240	240	* 7 mos.	*69 days

FIVE SANITARIUM PATIENTS.

Date. 1898	Name.	Occupation.	Habits and appearance.	Condition of disease.	Relative No. T.B. in sputum	Am't of sputum	Receptacle used for sputum.	Hour of last wash.	Hour of test wash.	T. B. in centrif. sedim't.	Weight of pigs. 1	Weight of pigs. 2	Result of inoculat'n: 1, periton. and groin	Result of inoculat'n: 2, groin only.
											gm.	gm.		
Mar. 10	Mr. K.	Undertaker.	Cleanly.	Pulm. tuberc., chron.; cavity; ambulant.	Numerous.	Moderate.	Cuspidor only.	9.30 A.M.	10.30 A.M.	None.	245	175	*112 days	†19 days cachectic
Mar. 10	Mr. B.	Clerk.	Cleanly.	Pulm. tuberc., chron.; no cavity; ambulant.	Not stated.	Moderate.	Cuspidor only.	8 A.M.	10 A.M.	None.	260	250	†38 days cachectic	†34 days cachectic
Mar. 10	Mr. A.	Farmer.	Cleanly.	Pulm. tuberc., chron.; no cavity; ambulant.	Numerous.	Profuse	Cuspidor only.	8 A.M.	10 A.M.	None.	240	270	†92 days‡	*102 days‡
Mar. 10	Mr. G.	Jeweller.	Cleanly.	Pulm. tuberc., chron.; cavity; ambulant.	Moderate.	Profuse	Cuspidor only.	8 A.M.	10 A.M.	None.	240	260	†57 days negative	†57 days tuberc. test
Mar. 10	Mr. S.	File setter.	Cleanly.	Pulm. tuberc., chron.; no cavity; ambulant.	Numerous.	Moderate.	Cuspidor only.	9 A.M.	10 A.M.	None.	250	300	†41 days‡	†127 days‡

* Died tuberculous. † Not tuberculous. ‡ Killed.

TABLE II.—THIRTEEN SANITARIUM PATIENTS.

Date. 1898	Name.	Occupation.	Habits and appearance.	Condition of disease.	Relative No. T. B. in sputum.	Amount of sputum.	Receptacle used for sputum.	Hour of last wash.	Hour of test wash.	T. B. in centrif. sediment.
Mar. 24	Mr. F.	Clerk.	Average clealiness.	Pulm. tuberc., chron.; cavity; (?) ambulant.	Moderate.	Moderate	Cuspidor only.	2 P.M.	5.45 P.M.	6 to 7
" 24	" B.	Com. travel.	Cleanly.	"	"	$\frac{1}{2}$ cuspidor 24 hours.	"	5.15 P.M.	" "	None
" 24	" T.	Store inspct.	Dirty.	"	Few.	$\frac{3}{4}$ cuspidor	"	8 A.M.	" "	1 to 2 (?)
" 24	" E.	Pianomaker.	"	" no cavity.	"	$\frac{1}{2}$ "	"	8 "	" "	None
April 2	" M.	Clergyman.	Very cleanly	"	Moderate.	$\frac{1}{4}$ "	"	8.30 "	12.45 "	"
" 2	" K.	Hosp. attend.	Cleanly.	"	"	$\frac{1}{2}$ "	"	" "	" "	1 to 2 (?)
" 2	" V.	Wallpap. pr.	" (?)	"	Numerous	$1\frac{1}{2}$ "	"	" "	" "	"
" 2	" D.	Iron worker.	"	"	Moderate.	$\frac{1}{2}$ "	"	" "	" "	"
" 5	Miss H.	Waitress.	"	"	Not noted.	1 "	"	" "	" "	3 to 4
" 5	Mrs. R.	Housekeeper	"	"	"	$\frac{1}{3}$ "	"	11 "	" "	None
" 5	Miss G.	"	"	"	"	Not noted.	"	8 "	" "	"
" 5	" G.	"	"	"	"	1 cuspidor 24 hours.	"	8 "	" "	4 to 5
" 5	" K.	Stenographer	"	"	"	None (?)	"	Not stated	" "	None

The results are tabulated, and it will be seen that in eight out of ten private patients one or both pigs became tuberculous, although in some the disease was extremely chronic, indicating that few bacilli or those of weak virulence had been inoculated. In two out of five sanitarium patients one pig in each was found to have tuberculosis of very chronic type. Lesions starting from the point of inoculation were demonstrated in all the positive cases. The tuberculin test was applied to a few doubtful ones. No relation between the severity of the disease in the patient and that of the animal can be made out, and I am inclined to think that it was merely a question of the number of inoculated bacilli. In two sets of animals only one became tuberculous, the other being found healthy when killed. The same result occurred in Cornet's[1] experiments in seven instances, and was ascribed by him to the small number of bacilli in the inoculated dust. Only one pig of the thirty died of apparent septic infection, a fortunate result probably due to the small amount of inoculated material.

It is significant to note that the two negative results among private patients were from ladies who were scrupulously careful by the use of cloths and cuspidors, and frequent washing, to keep their hands from being soiled. On the other hand, the two who used handkerchiefs only were readily found to furnish infection. In two cases where the expectoration was profuse, tubercle bacilli were very numerous in the centrifugation sediment, though in most cases when found microscopically at all there were very few. It is hardly possible they were excreted in the sweat from the experiments of Surmont[2] and Di Mattei.[3] Confusion with smegma bacilli was guarded against by washing the stained specimens with alcohol.

In three of the thirteen sanitarium patients the sediment contained a few bacilli, a result which justifies the opinion that handkerchiefs are little used at that institution.

It appears the better the social status of patients the more reluctant they are to use cheap, destructible handkerchiefs, cloths, and cuspidors. It is well known that the dried expectoration from washable handkerchiefs has long and correctly

been regarded as a fruitful source of infection disseminated about living rooms, and it needs no further argument to condemn their use. Whether there is any added danger from the hands as direct or indirect vehicles of infection depends principally upon the question of infection by ingestion, and I shall not presume to enter into that subject fully.

It is fair to suppose that the small amount of infectious material conveyed to clothing, bedding, furniture, books, money, pencils, etc., will have lost most of its virulence by the time it is dried and becomes dust. Inhalation tuberculosis must be rare from such sources. On the other hand, when the bacilli remain moist their virulence is retained, and the subtlety and frequent latency of tuberculous infection make it worth while to consider every possible source. And if it shall be shown, as Prof. G. Sims Woodhead[4] holds and Walsham[5] recently supports, that primary tonsillar infection is much more common than formerly supposed, then the hand as a carrier of the bacillus deserves more attention. The researches of Hodenpyl,[6] Jonathan Wright,[7] and others, are opposed to such a view, and it remains to be proven that the bacilli can pass the tonsils and cervical or mesenteric lymphatics, without causing lesions before they reach the bronchial nodes. Tuberculous lymphadenitis is, nevertheless, sufficiently common in the cervical nodes, especially in children; although primary mesenteric tuberculosis appears quite rare from the statistics of Northrup[8] and L. Emmet Holt.[9] The popular idea of the danger from tuberculous cattle is exaggerated, and I venture to suggest that some instances of the disease attributed to cow's milk may not exclude the much more common human source.

If virulent bacilli can be demonstrated on the fingers of patients of average cleanliness, what may not be the chances of food infection in the homes of the unclean!

We may gather a few points from these experiments:

1. That living tubercle bacilli are not infrequently present on the hands of patients who are not careful in the use of handkerchiefs, cloths, and even cuspidors, when the expectoration is abundant.

2. No precaution against contamination of the hands can avail better than the use of cuspidors, combined with frequent ablutions with soap and water.

3. In the present usages of society, people are not likely to use pocket cuspidors, except in institutions. Consequently, handkerchiefs will be used in public, especially since anti-spitting laws are forcing people to use them. There is, therefore, urgent need for a cheap, comparatively impervious, and soft handkerchief that can be burned.* This could be *specifically* recommended by physicians and boards of health for all diseases with expectoration. A rubber-cloth pocket-lining which could be washed would also be a desirable addition to suits made for invalids.

In closing I wish to acknowledge the assistance of Dr. J. A. Wilder in the details of the experimental work.

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DISCUSSION.

Dr. J. A. Hart: I have been particularly interested. I have had no experience with the pocket flasks. It does not appeal to me as being just exactly the article of toilet the patients would be willing

* Such as are suggested by Wise,[10] dipped in a solution of potassium nitrate, are, like absorbent gauze and paper handkerchiefs, too porous to be ideal receptacles for sputum.

to accept. My patients usually use cheese-cloth handkerchiefs, with instructions to destroy them. I have seen no cases in which tuberculosis has been traced to the infection of the fingers.

Dr. A. Jacobi: I think the paper should not pass without some expression of our appreciation of its value, for certainly it is valuable. Dr. Baldwin gives us another mode of propagation of tuberculosis. He does not say that the hands must necessarily in every case convey tuberculosis to another person, but that there is a possibility of such infection in this way, and that is what he meant to prove; I think he has proved his case. What he has demonstrated teaches again cleanliness as one of the methods of avoiding tuberculosis. The hands can be kept clean very much more readily than the air. The air of the room is very probably the most direct, as it is the most insidious of all the ways in which tuberculosis is propagated. We have been told that it is the dried dust on the walls and floor. When dust with bacilli is deposited on the wall or on the floor it takes a good strong air current to loosen that; but in the air in the room in which coughing and spitting (perhaps no spitting, still coughing) takes place there are always bacilli floating in the air. The very careful experiments of Flügge prove that in the air of a room where a patient had been coughing particles of muco-pus with bacilli in them will float from three to five or six hours. They will but gradually fall down. Thus it is that inhalation of bacilli takes place; that inhalation need not be a sure cause of tuberculosis, but, at least, it facilitates its admission. There is also the possibility and probability that those whose respiratory organs, whose mouth and nose, are near the floor, that is, children, will be more exposed to catching tuberculosis in this way than others. Now the doctor has brought to us another method in which tuberculosis may be contracted, and I think his efforts should be appreciated to their full value.

Dr. Vincent Y. Bowditch: I have listened with great interest to Dr. Baldwin's paper, more especially as I know the conservative tone he takes, in talking with him. I know he feels as I do of the unnecessary alarm felt, and the unreasonable attitude taken by many. At the same time we must know truth at any cost, and certainly he has proved to us very conclusively that there is a possible source of infection in this way, and that we can, by comparatively simple means, diminish the probability of infection.

Dr. Jacobi has mentioned the experiments of Flügge, to which I alluded in my paper yesterday. We must remember, however, that since Flügge made his statement Cornet has again experimented by shaking carpets covered with dried tubercular sputum in the presence of animals, and in very many cases infection took place, evidently from inhalation of the dust.

I also spoke of Dr. Curry's experiments, made after Flügge's

method, and of his conviction that the latter had greatly over-estimated the danger from inhalation of the so-called mouth-fluid droplets contained in the expired breath.

As I have previously stated, I believe we can adopt and teach methods of proper disinfection quietly and simply without creating terrorism.

As to the method of using cloths or pocket sputum flasks, of course, it is rather a matter of taste. To me personally the use of the flask is objectionable, but the method which we adopt at the Sharon Sanitarium, which has seemed as cleanly as any, is to have an absorbent cloth which, when the patient is out, is used to expectorate into. It is then wrapped up, put in a rubber pouch, from which it is later removed and the receptacle cleansed.

Dr. J. E. Stubbert: I have been very much interested in listening to the paper, but I really have had no experience excepting with reference to the last point made, that of carrying pocket-cases. I have always supposed what we have heard to-day to be the truth, that the hands would be a source of infection, and in view of that and also of the infection to be expected from the rubbing of the handkerchiefs in the pockets, I have educated my patients whom I could not expect to carry sputum-boxes to use pocket flasks, and have had very little difficulty in bringing them to realize their duty in the matter. I do not remember any case in my practice where I could trace an infection of a new member of the family to any exposure of this sort.

Dr. Coleman: I think the doctor has well applied his attention in showing that this is one of the many means by which we may become infected with the bacillus which is such an enemy to the human race.

I could not help but think when Dr. Stubbert suggested the flask idea what an elegant field for missionary work he would have in Kentucky.

Dr. A. D. Blackader: In connection with our own work in hospitals we have had the somewhat sad experience of two or three of our most active energetic students becoming infected with tuberculosis, and the question is whether the necessity for absolute and frequent washing of the hands in examining specimens microscopically is sufficiently emphasized upon students. In our clinical laboratories, it seems to me there should be some notice that students may have before them as to the necessity of cleansing their hands immediately after microscopical work. It was lately that that subject came before us in our hospital work in Montreal, and the question was brought to my mind by Dr. Baldwin's excellent paper.

Dr. Baldwin: I thank you very kindly for your free and generous discussion of my paper. I have had a feeling of some trepidation

as to the effect it might have, and, as I have said in the course of the paper, it is a subject which can be made a source of great exaggeration. If I have accomplished anything in making this study, I hope it will result in something practical; and to that end I have made some inquiries as to the possibility of obtaining a cheap handkerchief which would be within the range of our patients' pocketbooks and at the same time not be so cheap as to be excluded from good society by its appearance of cheapness. I think this applies more particularly to the ambulant cases in large cities, where in public places they are being forced to use these spitting cloths. I do not think it is a question so much for our health resorts, because there is a sentiment against handkerchiefs, and patients use them with some hesitation. I have here some samples of fabrics which represent the ordinary types which are used for expectoration. I will pass them around.

[The speaker exhibited samples of muslin, gauze, and cheese-cloth, giving the preference to a fair grade of bleached muslin, from which handkerchiefs can be made, with hem, to sell for ten to twelve cents a dozen.]

A SINGLE TEST OF THE VIRULENCY OF SPUTUM KEPT MANY MONTHS.

By IRWIN H. HANCE, M.D.,
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The virulence of the tubercle bacilli, as demonstrated by the clinical pictures of pulmonary tuberculosis and the experimental results on animals, presents a very wide range for our consideration; the resistance of these germs against disinfectants is also known to be great, and consequently one may expect them to retain their power of infection for many months.

Stone,[1] in 1891, reports an experiment in which the tubercle bacilli retained their form and virulence for three years. The writer undertook a similar experiment, and with a result so different that he deems it worthy of reporting to this Society.

On February 18, 1896, six guinea-pigs were inoculated with sputum which was secured from an old chronic case of pulmonary tuberculosis with large cavities. Eight weeks later all the animals being alive were killed; general tuberculosis of glands, abdominal and thoracic organs found in each pig. Large-mouthed bottles, half full of sputum, stopped with big corks, were put away in a pasteboard box on the top shelf of a closet until July, 1897—seventeen months later. The contents when examined were still of fluid consistency, about half the original quantity, of dark brown color, very little odor, with considerable deposit. After thorough mixing up of this sediment $1\frac{1}{2}$ c.c. was inoculated into the peritoneum of one and under the skin of a second guinea-pig. The former died in forty-eight hours from some septic poison; the latter lived

[1] Stone: American Journal of the Medical Sciences, March, 1891.

thirty days, when he was killed. Autopsy: no glandular enlargement and no evidence of tuberculosis.

On the same day 2 c.c. of the sediment were mixed with 2 c.c. of sterile water and centrifuged for ten minutes, thinking thereby to get the bodies of the tubercle bacilli without the toxin apparently present in the fluid. To this deposit in the tube, after decanting the supernatant fluid, 2 c.c. of sterile water were again added, and equal parts of this were injected into the groins of two guinea-pigs. Twenty-eight days later both pigs were killed, and autopsy gave a negative result. It should be noted that neither one of the guinea-pigs in the second experiment was at all sick after the inoculations. Also that the microscopic examination of the centrifuged sediment did not show any clearly outlined bodies of the tubercle bacilli, but fragmentary masses which retained the coloring matter, and were pronounced to be disintegrated tubercle bacilli by two other examiners beside the writer.

Having secured a negative result with this second experiment, one is justified in concluding that the tubercle bacilli in this case were no longer viable, and the following queries suggest themselves:

Does sputum which remains in a liquid state for a long time develop toxins which are inimical to the life of the tubercle bacilli?

Would the result have been different had the sputum been more virulent in its character, and taken from a case of acute active tuberculosis?

If sputum dries more rapidly, does it retain its virulency longer?

These can be answered only by further experimental work; and if the third query should be proved in the affirmative, it will be in accord with other experiments made with dust from rooms long since occupied by tubercular patients, and an added reason for disinfecting and cleansing the habitations of such persons.

SOME STATISTICS UPON SERO-THERAPY IN TUBERCULOSIS.

By J. EDWARD STUBBERT, M.D.,
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As a result of some years of investigation by eminent men, such as Koch, Maragliano, de Schweinitz, Trudeau, and many others, there seems to be among the profession a growing belief that there will be found a specific or an immunizing agency in either the bodies of the tubercle bacilli or in the serum of animals, which, by repeated injections of virulent or attenuated cultures of the same, have been rendered immune. Which one of these beliefs, if either, will prove correct is still to be determined. Unfortunately, many failures have been recorded from the use of the crude tuberculin, old and new, of Koch, Klebs' modification, and other extracts of the bacilli. There has been created a rebound of feeling amounting to distrust of all tuberculins and sera, which makes the profession exceedingly cautious in accepting data put forth as evidence of the value of sero-therapy in tuberculosis.

History. Among those inclined toward a specific mode of treatment the trend of opinion seems to be in the direction of antitubercle serum as derived from animals rendered partially immune by repeated injections of attenuated cultures of the tubercle bacilli. The history of antitubercle serum may be said to date back as far as 1890, although some unpublished work was done before that time. In that year Bernheim and Bertin both attempted the transfusion of goat's blood for tuberculosis. The next year Coupard and St. Hilaire used dog-serum in the form of intertracheal injections, and Hericourt

treated human subjects by dog-blood serum. In 1894 de Schweinitz succeeded in producing partial immunization of guinea-pigs; Babes, in 1895, made some experiments with dog-serum; Maragliano has for the past three years treated tuberculosis with ass-serum; Behring asserts that he has produced an antitubercle serum capable of arresting tuberculosis in small animals.

THEORY OF ACTION AND METHOD OF PREPARATION. While tuberculin, antiphthisine, tuberculosidine, and other extracts composed of the toxin of the bacilli are supposed to act indirectly upon the germ when injected into man, the antitubercle serum, such as prepared by de Schweinitz and Maragliano, is supposed, when introduced into the human body, to have an antitoxic effect. In manufacturing antitubercle serum, dogs, goats, asses, horses, and cows have all been used, but the horse seems to be the favorite animal in the hands of most experimenters. The methods of preparation of antitubercle serum employed by each of the aforesaid scientists differ.

Perhaps one fault is that we treat too much the effect rather than the cause of this disease; acknowledging the claim that the injections of the serum of an animal rendered immune will reinforce nature's own forces which are striving to correct a diathesis inherited, a soil already prepared for the nourishment of the bacilli, we find ourselves looking toward immunizing our patient; therefore, the use of the antitubercle sera of Maragliano, de Schweinitz, and others. The tubercle bacilli are inhaled in all our large cities by the majority of their populations, and we find that only 5 to 8 per cent. contract the disease; therefore, there are in nature forces which, if properly reinforced, may battle successfully with these germs, even if the odds are against them.

In 1894 de Schweinitz began treating animals for the purpose of providing possible immunity or resistance to tuberculosis by attenuated cultures. He says: "The production of this *partial immunity or artificial resistance* by attenuated cultures, already in 1894, suggested the advisability of this same method for the production of a serum that would have some

effect in curing tuberculosis. Two cows and one heifer were first selected and treated with tuberculin, or injected with the liquid culture media *in toto*, including the germs just as obtained from the incubation without any other treatment. The first few injections caused slight reaction, and occasionally local œdema or abscess was produced; subsequently this decreased. Guinea-pigs were then injected with the serum taken from these animals, and subsequently were inoculated with virulent cultures. The checks died within four or five weeks." Dr. de Schweinitz says further: "Without giving the details of the experiment, *we may say that the serum from the cows treated with tuberculin would cause in pigs slight resistance to the disease;* the serum of those treated with attenuated bacilli produced more resistance on the part of the animals, but not sufficient, as compared with the quantity of the culture injected, to make the use of cow-serum practical. The cow-serum, although sterile, frequently produced abscesses in guinea-pigs. While these experiments were in progress two horses were pressed into service and were injected with attenuated culture fluid and bacilli; after a time the abscess-formation almost ceased." The effect of the serum he also tried in preventing the rise of temperature and in counteracting a fatal dose of tuberculin in tuberculous guinea-pigs. There is one encouraging point to be noted in this connection: that these experiments have been made upon guinea-pigs, which are well known to be very rapidly affected by tuberculosis. By noting that the immunizing is a gradual process it would seem that the resisting powers ought to be proportionately better in the human subject. de Schweinitz finally says: "*The experimental results obtained lead undoubtedly to the conclusion that the treatment with antitoxic serum is still in the experimental stage, and should as yet be used only in sanitariums and under the best conditions. We are on the road to success in the treatment of this disease, and nearer our goal than ever before.*"

STATISTICS AT LARGE. The favorable results reported so frequently from the use of different antitubercle sera by numer-

ous physicians lead members of the profession to be suspicious, feeling that there might be a commercial side to the records presented, especially when our desks are loaded down with short résumés of five or six cases treated with one particular serum or another by men who have not been known among their professional brethren before the appearance of these reports. This mistrust is especially engendered when these same reports are published at the expense of, and offered to us by, the commercial houses controlling the output of the different sera. Still there have been among the many reported cures a sufficient number that seemed credible; and the names of a few of the investigators and reporters have stood so high in the profession as to make it obligatory upon us to investigate constantly and carefully along the line of sero-therapy in the treatment of tuberculosis. Maragliano claims good results, and other men of note have reported a few favorable cases from its use.

While we should urge strongly the need of still adhering to the climatic, hygienic, and dietetic treatment that long experience has established, it would appear to be our duty to constantly search and investigate by the records of accumulated cases for further evidence as to the efficiency of serum treatment. Dr. de Schweinitz, Director of the Biochemic Laboratory of the Bureau of Animal Industry, at Washington, D. C., some two years ago proposed placing in the writer's hands, on non-commercial, purely scientific grounds, an antitubercle serum manufactured by the Government, to be used for purposes of experimentation. Having been impressed by the sincerity of this proposition, the writer immediately began to treat cases under his care at the Loomis Sanitarium, at Liberty, N. Y., and among his patients in private practice, for the purpose of ascertaining, if possible, whether patients could not only be cured, but immunized by this treatment; and in following this line of investigation he has been led to use in a few cases incidentally, in addition to the de Schweinitz serum, Paquin's antitubercle serum, Fisch's serum, Hirschfelder's oxy-tuberculin, and Pasteur's antistreptococcic serum.

Remarks. Dr. Janeway tells me he has known but one favorable result from the use of antitubercle serum, and that was a patient of Dr. Trudeau's. Dr. S. S. Jones, of New York City, has used this serum in three cases—two in the incipient stage and one far advanced. His observations in these cases lead him to believe that this serum is possessed of tonic qualities, but no specific virtues. Dr. R. M. Meade, of Brooklyn, has used antitubercle serum in four cases with very gratifying results. The writer has treated two cases living in New York City, one of whom did remarkably well, while in the other the results were unfavorable. The first case was in the incipient stage, the other one in the far-advanced stage.

The serum of Dr. Fisch was tried in six cases at the sanitarium; but as every one of them showed bad results they were transferred to other serum, or treatment. Some of the bad results encountered from the use of this serum were eruptions and severe reactions.

Paul Paquin's serum was also used in about eight cases, but as the percentage of good results were lower than from the use of other serum, its use was finally abandoned. Very severe reactions were encountered from the use of this serum. In one case the bacilli disappeared for a short time, but subsequently reappeared.

It is but just to these gentlemen to state that other observers have reported favorable results from the use of their sera.

Class in which Indicated. The use of antitubercle serum would seem to be indicated only in incipient cases and in those presenting a pure culture or simple infection. This, of course, refers to those cases which we hope to be able to cure. In the writer's experience it has seemed in a few advanced cases to temporarily retard the progress of the disease; it reduced temperature and increased materially the strength of the patients. I remember one case especially, whose physical signs were as follows: Dulness over entire right lung; cracked-pot resonance to second interspace; large mucous râles right side to nipple; gurgles and subcrepitant râles at second interspace; crepitant and creaking râles right side post. Amphoric respi-

ration over site of cavity; increased vocal resonance and bronchial respiration apex to nipple. This patient had become so ill as to be confined to one of the infirmary beds of the sanitarium, and was unable to walk even across the room. Every possible effort had been made to ameliorate her condition, but without success. To please her, against my judgment, simply as a placebo, I directed that she be given 15 ♏ of de Schweinitz's serum on alternate days. Within a short time her appetite returned, temperature was slightly reduced, she was able to move around the room, and, finally, to my astonishment, I met her one day walking around the sanitarium grounds. The effect upon this case was, of course, only temporary, and after a few months the patient died. Generally speaking, the use of antitubercle serum would seem to be *contra-indicated* in the third stage of pulmonary tuberculosis, marked cases of softening or excavation, those of marked hereditary taint, in cases presenting a very rapid heart-action with relative feebleness of arterial pressure, and in those in whom corpulence, vital capacity, and conformation of the chest are much below the normal standard; also in cases of marked mixed infection. Maragliano does not, I believe, agree with this statement, claiming that the use of antitubercle serum is indicated in all cases and in all stages.

Accidents in Administration. There seems to be but little, if any, danger attendant upon the administration of serum, if the proper precautions in the way of antisepsis are observed in its use. Urticaria, erythema, and other forms of eruptions, painful swellings at the point of injection, stiffness, pain, and sometimes swelling in the different joints, especially in patients presenting rheumatic histories, enlargement of the axillary glands, and myalgia, are met with in a small percentage of cases. These symptoms, however, are not dangerous, only annoying, and even in the small percentage of cases who present them are seldom repeated during subsequent treatment. The only really alarming symptom that has ever been observed by the writer has been a sudden attack of syncope lasting from one to two minutes; some claim this is due to the serum being

passed directly into a small vein, while others say it is caused by too frequent injections at a given point.

CLINICAL SYMPTOMS IN SUCCESSFUL CASES. The advantages of serum treatment are: 1. It does not tax the functions of digestion, or produce gastritis, diarrhœa, or loss of appetite. 2. In cases wherein the bacilli have disappeared *they have been lost while sputa were still present*, whereas in creosote cases the last specimens of sputa contained bacilli. 3. Up to the present time *no relapses have occurred* among our patients declared cured by serum treatment; they are occasionally met with in creosote cases. Some of our serum patients after leaving here have been subjected to rather serious climatic and hygienic tests without mishap. There would appear to be established a certain immunity in cases cured by serum, but how lasting this may be is still to be determined.

LENGTH OF TIME TO BE ADMINISTERED. The length of time that antitubercle serum can be given advantageously in cases *improved* or *arrested*, but not cured, would seem to be about six or seven months, and thereafter it not only appears *non utile*, but gives rise to unpleasant symptoms. In cases apparently *cured* under the administration of serum it has been my custom to continue its use for two or three months ofter the disappearance of tubercle bacilli. In these cases no unfavorable results have been noted from its long use.

ANTISTREPTOCOCCIC SERUM. While, as seen above, the results from the use of antitubercle serum have been exceedingly gratifying in cases showing a pure culture, the most alarming symptoms and trying complications with which the physician meets in tuberculosis are due, not to the tubercle bacillus, but to the cocci of mixed infection. The most virulent one of these seems to be the streptococcus, and the profession is watching with great interest the result of the use of Marmorek's antistreptococcic serum, in the hope that in tuberculosis with mixed infection (the most common variety met with) the disease may be reduced to one of simple tuberculous infection that would readily yield to antitubercle serum. This hope is a legitimate one in view of the excellent results reported

from its use in erysipelas, active abscesses, pelvic inflammation, otitis media, and acute and chronic suppurative processes generally. Paquin claims to have obtained good results in almost all cases of mixed infection from the administration of antistreptococcic and antitubercle serum on alternate days.

Knopf, in the *Medical Record*, February 13, 1897, recommends its use in early cases, remarking that, generally, good results are not to be looked for when the temperature is higher than 101° F. Weaver, in the *Journal of the American Medical Association*, reports a case in which one dose of this serum reduced the temperature from 105° to nearly normal; he fails to state whether it remained so. Cox, in the *Journal of the American Medical Association*, September 11, 1897, refers to three successful cases of Weaver, and beyond that deals in generalities and hopes.

The writer has been led to employ in six cases of mixed infection Pasteur's antistreptococcic serum (selecting, of course, only such cases as showed streptococci), believing that if the secondary infection could be neutralized, a clear field would be left for the supposed action of the antitubercle serum. In the first case only one injection was employed; expectoration ceased immediately for a number of days, and then returned in diminished quantity; on examination the streptococci were found to be far less numerous.

The next case had suffered from chronic bronchitis for three or four years, and developed tuberculosis a short time before entering the sanitarium, about sixteen months ago. Tubercle bacilli disappeared under treatment, but bronchitis remained. The sputa were muco-purulent in character, and contained streptococci. One injection of the antistreptococcic serum was given, after which cough and expectoration increased materially. After a few weeks the patient began to improve, expectoration decreased somewhat in quantity and became very markedly less purulent in character. This patient is now living in New York, and I have lost trace of her.

The next patient had a dry cavity at one apex; she had done very well at the sanitarium. She was given four injections

of the antistreptococcic serum, after which the streptococci disappeared. This patient is still an inmate of the sanitarium, and her sputum still contains tubercle bacilli.

The next case was a young lady whom I have treated, first as a private patient, then as an inmate of the sanitarium, for the past fifteen months. Tubercle bacilli disappeared from her sputum, the physical signs cleared up, and she was about to return home cured of tuberculosis. However, she also had a history of chronic bronchitis, but with scanty expectoration. About the time she was to be discharged from the sanitarium numerous and long chains of streptococci were discovered in her sputa, and she was immediately given an injection of 10 c.c. of antistreptococcic serum, and two days later a second dose of 10 c.c. After the first injection a slight increase of expectoration was observed, but a few days after the second injection no streptococci could be found, nor for four months thereafter; at the end of that time, they reappeared.

In a fifth case three injections were given, but without any effect. The sixth case was given two injections at intervals of ten days; after the first injection the streptococci were greatly reduced, and after the second injection they had disappeared entirely. This patient is still an inmate of the sanitarium, and, at the end of six weeks, the streptococci have not reappeared.

I cannot agree with the statement that it is advisable to administer this serum at such short intervals as forty-eight hours, as in the only two cases in which I have done so there have been marked systematic disturbances; it is certainly more comfortable to the patient and the results have appeared to be equally good when from one to three weeks have been allowed to elapse between injections. Generally the streptococci decrease very greatly or disappear entirely after the second administration of the serum, and, in exceptional cases, one injection has been found all that was necessary. The largest number of injections given by the writer in a single case of pulmonary infection has been four.

The results recorded above have led the writer to adopt the

plan of using this serum regularly in conjunction with the antitubercle serum, but less often than recommended by some others. The question of the efficacy of this serum would still seem to be *sub judice*, but in all sanitariums and in private practice among specialists in this disease, where a sufficient number of cases of this mixed infection can be found, a careful investigation should be carried on during the coming year.

A summary of the results of eighty-two cases treated with antitubercle serum at the Loomis Sanitarium is given below. These cases have been divided for convenience into three classes—namely, incipient or slight localized involvement of lung, with little or no constitutional disturbance; moderately advanced or more general consolidation of lung, with constitutional disturbances and beginning of softening, or single cavity; far advanced, or softening and excavation, with marked constitutional disturbances.

Number of cases treated	82	
Expectoration decreased in	82	per cent.
Appetite improved in	81	"
Weight gained in	78	"
Physical signs improved in	78	"
Temperature decreased in	49	"
Bacilli disappeared in	13	"
Bacilli decreased in	35	"
Cough decreased in	79	"
Apparent immunity established in	21	"
Generally improved	78	"

THIRTY-SIX INCIPIENT CASES.

No.	Age	Length of time ill before entrance.	Family history.	Hemorrhages.	Night sweats.	Weight.	Temperature.	Bacilli.	Time in sanitarium.	Approximate No. of injections.	Physical signs.	Result.
1	23	2 months	Negative	None	None	Gain 16 lb.	Decreased	Disappeared	10 months	36	Improved	Cured
2	14	Coughed 7 years	Obscure	None	None	Gain 10 lb.	Normal	Disappeared	8 months	12	Improved	Cured
3	20	Coughed 9 years	Negative	One	Disappeared	Gain 5 lb.	Normal	Disappeared	15 months	60	Improved	Cured
4	17	Always winter-cough	Tubercular	None	Disappeared	Gain 15 lb.	Normal	Disappeared	7 months	60	Improved	Cured
5	22	1 year	Obscure	None	None	Lost 10 lb.	Unchang'd	Stationary	11 months	24	Worse	General condition worse
6	22	Morning-cough 2 years	Negative	None	None	Gain 40 lb. (in 4 mo.)	Normal	Disappeared	8 months	60	Improved	Cured
7	17	5 months	Tubercular	None	Disappeared	Gain 6 lb.	Normal	Disappeared	10 months	64	Improved	Cured
8	36	2 months	Tubercular	None	Disappeared	Gain 11 lb	Normal	Had none	6 months	48	Improved	Cured
9	16	1 month	Tubercular	None	None	Gain 7 lb.	Normal	Had none	3 months	30	Improved	Cured
10	18	18 months	Tubercular	None	None	Gain 22 lb.	Decreased	Decreased	1 year	90	Improved	Improved
11	24	5 months	Tubercular	None	Disappeared	Gain 6 lb.	Decreased	Disappeared	4 months	42	Improved	Dis.arrest'd
12	23	5 months	Negative	None	Disappeared	Stationary	Stationary	Decreased	9 months	10	Stationary	General condition stationary
13	32	Obscure	Obscure	None	None	Gain 12 lb.	Decreased	Disappeared	3 months	30	Improved	Cured
14	38	5 months	Tubercular	None	None	Gain 4 lb.	Stationary	Decreased	7 weeks	18	Improved	Improved
15	30	Obscure	Negative	None	None	Gain 2 lb.	Decreased	Decreased	3 months	36	Improved	Improved
16	32	3 months	Negative	None	Disappeared	Gain 8 lb.	Decreased	Decreased	2 months	24	Improved	Improved
17	35	11 months	Negative	Slight	Yes	Gain 6 lb.	Stationary	Decreased	6 months	60	Improved	Improved
18	23	4 weeks	Negative	Slight	None	Gain 17 lb	Decreased	Had none	10 weeks	30	Improved	Cured
19	34	2 months	Obscure	None	Disappeared	Gain 5 lb.	Stationary	Decreased	5 weeks	18	Improved	Improved
20	56	Run down	Negative	None	None	Gain 2 lb.	Normal	Decreased	5 weeks	18	Improved	Improved
21	21	18 months	Tubercular	None	None	Gain 3 lb.	Decreased	Disappeared	5 months	54	Improved	Cured
22	51	3 months	Negative	Slight	Disappeared	Gain 2½ lb.	Decreased	Decreased	3 months	28	Improved	Arrested
23	41	1 year	Negative	None	Disappeared	Gain 15 lb.	Normal	Disappeared	7 months	46	Improved	Cured
24	31	2 months	Negative	None	None	Gain 11 lb.	Decreased	Disappeared	7 months	64	Improved	Cured

25	44	9 months	Negative	None	None	Gain 14 lb.	Decreased	Decreased	4 months	46	Improved	Arrested
26	33	12 years	Tubercular	Yes	None	Gain 3 lb.	Decreased	Decreased	6½ mos.	26	Improved	Improved
27	19	1 year	Tubercular	None	Disappeared	Gain 8 lb.	Normal	Had none	3½ mos.	40	Improved	Cured
28	34	6 months	Negative	None	None	Gain 6 lb.	Stationary	Stationary	3 months	30	Improved	Improved
29	34	2 months	Negative	None	None	Gain 12 lb.	Normal	Had none	5 weeks	15	Improved	Cured
30	30	8 weeks.	Negative	None	Disappeared	Gain 7 lb.	Decreased	Decreased	4 months	46	Improved	Improved
31	26	Subject to cold	Negative	None	None	Gain 5 lb.	Normal	None	4 weeks	12	Improved	Improved
32	25	3 months	Negative	None	Decreased	Gain 8 lb.	Stationary	Stationary	Still here	21	Improved	Improved
33	22	2 months	Negative	Yes	None	Gain 6 lb.	Stationary	Decreased	5 months	24	Improved	Improved
34	25	3 months	Tubercular	None	Decreased	Gain 2½ lb.	Stationary	Decreased	Still here	12	Improved	Improved
35	21	1 month	Tubercular	Yes	Disappeared	Gain 7 lb.	Decreased	Decreased	Still here	24	Improved	Improved
36	28	1 month	Tubercular	Slight	Disappeared	Gain 8 lb.	Decreased	Had none	Still here	10	Improved	Improved

FORTY-TWO MODERATELY ADVANCED CASES.

1	31	6 years	Negative	Yes	None	Stationary	Stationary	Decreased	7 months	26	Improved	Improved
2	42	18 years	Tubercular	Yes	Disappeared	Gain 2 lb.	Stationary	Stationary	5 months	44	Improved	Improved
3	36	5 weeks	Negative	None	Disappeared	Stationary	Stationary	Stationary	10 months	48	Stationary	Stationary
4	27	2 years	Negative	None	Decreased	Stationary	Stationary	Decreased	Still here	60	Improved	Improved
5	18	1 year	Negative	Slight	None	Lost 6 lb.	Stationary	Stationary	5 months	44	Worse	Worse
6	21	7 months	Tubercular	None	Disappeared	Gain 2 lb.	Stationary	Stationary	5 weeks	15	Improved	Improved
7	38	6 weeks	Negative	Yes	Disappeared	Stationary	Decreased	Stationary	8 weeks	22	Improved	Improved
8	30	1 year	Negative	None	None	Gain 2 lb.	Stationary	Stationary	4 weeks	12	Stationary	Stationary
9	35	4 months	Negative	None	None	Gain 14 lb.	Decreased	Decreased	6 months	60	Improved	Improved
10	38	3 years	Tubercular	None	Disappeared	Gain 2 lb.	Decreased	Stationary	2½ mo.	30	Improved	Improved
11	26	5 months	Negative	None	Disappeared	Gain 1 lb.	Stationary	Stationary	13 months	60	Stationary	Stationary
12	19	10 months	Negative	Slight	Disappeared	Gain 5 lb.	Decreased	Stationary	2 months	15	Improved	Improved
13	24	18 months	Obscure	Slight	None	Gain 2 lb.	Decreased	Decreased	Still here	70	Improved	Improved
14	25	2 months	Negative	Yes	None	Gain 8 lb.	Decreased	Decreased	16 months	70	Improved	Improved
15	23	18 months	Negative	None	Disappeared	Gain 16 lb.	Decreased	Decreased	8 months	70	Improved	Improved
16	24	5 months	Negative	None	None	Stationary	Decreased	Decreased	14 months	15	Improved	Improved
17	34	2 months	Negative	None	None	Stationary	Decreased	Stationary	3 weeks	9	Improved	Improved
18	30	8 years	Obscure	None	None	Gain 8 lb.	Decreased	Stationary	1 year	60	Improved	Improved
19	25	8 months	Tubercular	Slight	Decreased	Lost 4 lb.	Decreased	Stationary	7 months	15	Stationary	Stationary
20	34	2 months	Tubercular	Yes	Yes	Lost 10 lb.	Stationary	Stationary	7 weeks	18	Unimprov.	Worse
21	17	9 months	Obscure	None	Disappeared	Gain 4 lb.	Decreased	Stationary	7 months	20	Improved	Improved
22	24	5 months	Tubercular	Slight	Yes	Lost 3 lb.	Stationary	Stationary	11 months	80	Worse	Worse
23	35	7 years	Tubercular	None	Decreased	Gain 2 lb.	Stationary	Stationary	5 months	15	Improved	Improved
24	17	3 months	Negative	None	None	Stationary	Stationary	Stationary	Still here	18	Stationary	Stationary
25	24	1 year	Tubercular	None	None	Gain 1 lb.	Stationary	Decreased	7 weeks	20	Improved	Improved

FORTY-TWO MODERATELY ADVANCED CASES.—*Continued.*

No.	Age	Length of time ill before entrance.	Family history.	Hemorrhages.	Night sweats.	Weight.	Temperature.	Bacilli.	Time in sanitarium.	Approximate No. of injections.	Physical signs.	Result.
26	27	7 months	Tubercular	Yes	None	Stationary	Stationary	Stationary	4 months	14	Stationary	Stationary
27	34	4 months	Tubercular	None	Yes	Lost 6 lb.	Stationary	Stationary	3 months	30	Worse	Worse
28	12	3 years	Negative	None	None	Stationary	Decreased	Stationary	2 months	22	Improved	Improved
29	21	Always sickly	Negative	None	Disappeared	Stationary	Stationary	Decreased	2 months	18	Improved	Improved
30	32	6 years	Negative	None	None	Lost 4 lb.	Stationary	Stationary	Still here	56	Unimprov.	Worse
31	36	1 year	Negative	None	None	Gain 2 lb.	Decreased	Stationary	2 months	24	Improved	Improved
32	24	6 months	Negative	None	None	Gain 2 lb.	Decreased	Stationary	Still here	60	Improved	Improved
33	36	5 weeks	Negative	Yes	Disappeared	Gain 2 lb.	Decreased	Stationary	Still here	24	Improved	Improved
34	36	2 years	Negative	Yes	None	Gain 7 lb.	Decreased	Decreased	Still here	70	Improved	Improved
35	35	10 months	Negative	Yes	None	Gain 1½ lb.	Stationary	Stationary	2 months	18	Stationary	Stationary
36	25	3 years	Negative	Yes	None	Gain 8 lb.	Stationary	Stationary	Still here	12	Improved	Improved
37	28	5 months	Negative	None	None	Gain 7 lb.	Decreased	Decreased	Still here	48	Improved	Improved
38	38	6 months	Tubercular	None	Disappeared	Gain 1 lb.	Decreased	Stationary	Still here	16	Improved	Improved
39	26	1 year	Negative	None	None	Gain 1 lb.	Stationary	Stationary	Still here	16	Stationary	Stationary
40	56	Several yrs	Tubercular	Slight	Disappeared	Gain 2 lb.	Stationary	Stationary	Still here	15	Improved	Improved
41	21	7 months	Tubercular	None	None	Gain 3 lb.	Stationary	Decreased	Still here	20	Improved	Improved
42	31	Always sickly	Tubercular	Yes	None	Gain 2 lb.	Decreased	Decreased	Still here	15	Improved	Improved

FOUR FAR-ADVANCED CASES.

1	28	18 months	Negative	None	Yes	Stationary	Stationary	Stationary	4 months	18	Stationary	Stationary
2	19	1 year	Negative	None	None	Stationary	Stationary	Stationary	4 months	20	Stationary	Stationary
3	22	4 months	Tubercular	None	None	Gain 1 lb.	Decreased	Stationary	14 months	20	Improved	Improved
4	37	6 years	Obscure	None	None	Gain 1 lb.	Stationary	Stationary	Still here	12	Stationary	Stationary

SUMMARY.

Thirty-six Incipient Cases.

Number of cases treated .	36
Expectoration decreased in	94 per cent.
Appetite improved in . .	94 "
Weight gained in . . .	94 "
Physical signs improved in	94 "
Bacilli disappeared in .	30 "
Bacilli decreased in . .	41 "
Cough decreased in . .	94 "
Generally improved . .	94 "

Forty-two Moderately Advanced Cases.

Number of cases treated . .	42
Expectoration decreased in .	85 per cent.
Appetite improved in . .	83 "
Weight gained in . . .	61 "
Physical signs improved in .	71 "
Bacilli decreased in . . .	30 "
Cough decreased in . . .	82 "
Generally improved . . .	71 "

Four Far-advanced Cases.

Number of cases treated .	4
Expectoration decreased in	25 per cent.
Appetite improved in . .	25 "
Weight gained in . . .	50 "
Physical signs improved in	25 "
Cough decreased in . .	25 "
Generally improved . .	25 "

NOTE. The percentages of good results from the use of antitubercle serum, as regards temperature and tubercle bacilli, are less during the summer than winter months; and it is an interesting fact that this remark can be applied to all lines of treatment. Incidentally I wish to state that I have been very much surprised, during my two winters' experience at Liberty, to find that, for patients possessing an average power of resistance, high winds and exercise in unprotected places have not been detrimental; on the contrary, such persons have improved far more rapidly than during the comparatively mild weather.

The treatment of cases of laryngeal tuberculosis has received special attention at the sanitarium, and the results compare most favorably with reports from other health resorts; the results in these cases have been as follows:

Cases with ulceration healed	50 per cent.
Cases without ulceration arrested	46 "

Of these laryngeal cases serum has been used in seven, and, although no immediate results were apparent in the larynx, it is possible that the serum contributed in some degree to the favorable percentages.

In closing, I wish to place myself distinctly on record as not being as yet a thorough convert to sero-therapy in the treatment of tuberculosis; I appear before you simply as an investigator of this subject; I believe that we are investigating along the right line, that the results of serum treatment are, as a whole, more satisfactory than treatment by any one drug; but, as yet, we have found no specific for this dread disease.

DISCUSSION.

DR. E O. OTIS: All I can contribute to the discussion is that last winter I tried the antistreptococcus serum in a few cases of advanced phthisis with mixed infection, and obtained negative results. The immediate effect was very much like a tuberculin reaction; the temperature was rather raised than lowered, and no improvement was manifest in the general symptoms. The site of injection in the back

remained painful for some days, and so much discomfort in general was produced that most of the patients begged not to have it repeated.

Dr. Hinsdale: I have had encouraging experience, but have used serum in few cases, one of which I reported to the Association a year ago, with the statement that I would give the ultimate result at this meeting. That patient whose history was detailed has maintained her health and is living and well to-day, although at the outset it was a very unfavorable case for treatment. I have in one case given fifty injections, giving it first on alternate days, and afterward weekly and at intervals of two weeks until fifty injections were used, and there have been no unfavorable symptoms, no local disturbances. I happen to have received a letter from that patient this morning before coming here. I sent him to the mountains of Pennsylvania, where he is steadily improving, and, although the bacilli did not disappear as in the first case, yet his symptoms have wonderfully improved. I have tried the serum in other cases, but not for sufficient length of time to report satisfactorily. The results of serum treatment are certainly encouraging, and it is by such work as Dr. Stubbert has given us that we may be able to give a correct estimate of its value.

In answer to an inquiry Dr. Hinsdale further stated that the serum he had used was that prepared by H. K. Mulford & Co., and that it was made from donkeys. It is made in the same general line that the serum of de Schweinitz is made. They have not put it on the market. It has not been sold, although a few physicians have been given at their own request a supply for giving it a trial.

Dr. W. D. Robinson: I have used sero-therapy in four cases, and have found the local irritation and often suppuration a means of great interference. In one case of laryngeal ulceration the ulceration did seem to be modified by the treatment. Dr. Von Ruck has stated that he has had quite as satisfactory results when the rectum had been used, after being thoroughly cleansed, for the administration of the antitubercle serum.

Dr. Hart: I should like to ask the doctor if he has had any experience in laryngeal cases, and found any results from the use of the serum.

Dr. Glentworth Butler: This whole subject is certainly one of interest, but it seems to me it will be very difficult to come to any satisfactory conclusion, partly because of the large number of preparations of this kind that have been offered. I think there are at least twelve, possibly more, varieties of serum which have been offered, and it will evidently require a vast number of observations. My present experience with the serum has been like that of many practitioners, very slight. I have used, mainly because of the urgency of friends, the Paquin serum. I had a rather curious experience with oxy-tuberculin (Hirsch); a case in the hospital had been taken ill

with symptoms of broncho-pneumonia. In the course of two and a half weeks the temperature went down to normal in the morning, and ran up to 103° in the afternoon. An examination of the sputum revealed tubercle bacilli in large numbers. One of my philanthropic patients who had lost a daughter by this disease was very anxious to have the oxy-tuberculin tried. The effect was really remarkable for the better. Inside of ten days the temperature had fallen to 101° in the evening, and in ten days further the temperature was normal. The patient left the hospital and has remained perfectly well. A second case gave nearly as good results, although it has passed out of observation, and I do not know the subsequent history.

One word in regard to the antistreptococcic serum. I have to say that in several streptococcic cases, notably in streptococcic pneumonia, in four out of five of them the results have certainly been satisfactory in bringing down the temperature, and apparently contributing to the recovery of the patient. At the same time on the surgical side of the Methodist Hospital it has proven of extreme value in many cases of deep-seated suppuration and streptococcic infection. The preparation used was that made by Parke, Davis & Co.

Dr. E. R. Baldwin: We have devoted more time to laboratory study of the serum than to the clinical, and it is really unfair for me to make any statement which would either favor or disparage whatever may be the value of the various serums. Dr. de Schweinitz has been very kind to send us some of his serums, and our experimental results have been published recently by Dr. Trudeau and myself. We jointly wrote a paper which appeared before the Association of American Physicians. The clinical use of the serum has been very limited in the sanitarium. Dr. Stubbert referred to a case which Dr. Janeway mentioned; I have a recollection of that case as being a febrile one, and it did seem to reduce the fever. The reason that we do not use the serum more is that we have not reached the point in the laboratory studies that has given us a great deal of encouragement. It is, nevertheless, true that possibly results on human beings may be better than on the lower animals. We would, at least, expect to prolong the lives of guinea-pigs. I believe that Dr. de Schweinitz has some evidence to that effect. We have not, as yet, seen any published details of his recent work.

Dr. Walter F. Chappell: I have never personally given an injection of serum, but have had an opportunity during the past year to watch the cases of laryngeal tuberculosis treated at the Loomis Sanitarium, at Liberty. I make trips about once a month and look at the cases and watch their progress. The percentage of favorable results obtained in the Sanitarium within the last year exceed everything I have seen before. To be sure, they have had the best possible food and surroundings, and at the Loomis Sanitarium they have been

doing everything they could to help in the local treatment by properly selected medication; and while I think the serum may possibly have had some effect on the laryngeal lesions, I am not prepared to say that it has; but the results have been very good, whether from the treatment or general surroundings, I am not able to say.

Dr. Stubbert: Replying to the question asked by Dr. Hart in reference to the treatment of laryngeal cases, I will ask Dr. Chappell to make a statement in regard to that department. I will simply preface what he may say by speaking of the lung conditions in such cases. One case had a localized process of the right lung. The process was undoubtedly arrested. This case had rather severe laryngeal complication.

As to the question of sore backs: when massage is given afterward we have no difficulty whatever in the administration of the antitubercle serum. However, I cannot recommend the use of oxygen tuberculin. The "Round Robins" issued at Santiago were nothing to a letter I received in my office from patients whose backs were made sore by its use; but as strict antisepsis and massage were employed, I attribute its intolerance to the large amount of fluid injected at one time. Until the discussion of the paper was on I did not mention any particular case; there are some in which we have bad results: One patient, a young lady, who came to me and remained about seven months, with a slight process of the right apex, never received a dose of medicine other than antitubercle serum. She gained twenty pounds, and is living at present in Summit, N. J. The most encouraging case was that of a girl who gained forty pounds in four months. The tubercle bacilli disappeared in three months. She has now been at work in New York City as a telephone girl, living in a district of the lower-class flats, with a family in moderate circumstances, something like fifteen months, and has been working every day. Of these forty pounds she lost seven, which left her considerably above her average weight. Another patient gained something over ten pounds. He was in the sanitarium altogether perhaps four months. The day before he left he walked twenty-five miles without having any untoward symptoms, and has been working in New York City without any return of the disease.

Regarding the use of this serum in other places: In New York City it has been used by Dr. S. S. Jones in three cases. In one case the disease was checked, and the patient kept alive for some months. He said he was going to have a good time, and he died suddenly with a large hemorrhage. Dr. Jones told me the disease had remained in abeyance as far as he could tell. Another patient lost the tubercle bacilli in New York under the use of tubercle serum. I saw him three or four days ago, and his lungs were normal.

CLIMATOLOGY OF NUDITY: PARTIAL AND COMPLETE.

By WILLIAM DUFFIELD ROBINSON, M.D.,
PHILADELPHIA.

The present words are presented as a preliminary to what I hope later to offer in greater detail, giving results of observations and experiments as yet incomplete. Accessible literature on the subject is meagre, and, from its antiquity, is untrustworthy. I restrict the present contribution to the results of light on the nude human body, reserving for a later study the effects of the absence of artificial covering of the skin. Loose generalized observations have been made of the influence of residence in localities where the volume and intensity of light were most dissimilar. In these extremes the effect of the action of light on humanity was readily recognized. How it acted has not been recorded. Whether through its influence on air and microscopical and macroscopical animal and vegetable life, or by direct action on man through his skin or visual organs, is not shown. I could find no record showing that blind persons suffering from incipient tubercular disease or other deviation from health were not as favorably impressed by sunlight as those possessed of sight. There have been sufficient semi-scientific and unscientific observations to indicate the importance of a more complete elucidation of the action of light on medical as well as on purely scientific lines. That it is a factor of potent influence in profoundly impressing man in his development from infancy to maturity, and in health and disease, has been shown by safe deductions, by analogy, from the

study of vegetable and lower forms of animal life. Some effort has been made to learn whether the action of light on man was through visual impressions or by its effect in inducing structural and chemical changes in the skin, its capillaries or blood, or by changing the conditions of environment by the action of light on the air and its contained micro-organisms. To what extent the respiratory power of the skin may be influenced by exposure to full sunlight is not known. The destroying and inhibiting effect of light on the growth of micro-organisms is proved to be enormous. In infectious diseases, where the germs are known to circulate in the blood, may it not be that the penetration of light into the blood when it is so expansively exposed as in the cutaneous circulation is potent in curative result? If such effects are possible on germs in the blood-current, may these effects not be caused by the assistance of light in destroying toxins and developing antitoxins as much as by direct impression on the organisms? As a negative support to the theory of the power of light over micro-organisms in the blood, it is observed among negroes and Indians when exposed to tubercular infection, that their resistance is feeble, and the progress of the disease is rapid and deadly. Their pigmented skins enormously prevent light penetration. Many substances have the property of storing up light, to be slowly emitted later. The possibility of some of the constituents of the blood having this power should be considered. The tremendous influence of light on the *vegetable* kingdom distinct from differences of temperature needs only reference. Like studies have been made of lower *animal* life, as in frogs, from hatching, through the evolution to the completion of their adult development, eliminating heat as a factor by control experiments. It has been shown that without light almost no spores could be hatched. Life, evolution, and development were either restricted, entirely checked, or greatly modified.

The study of man removed from light or exposed to its greatest intensity gives opportunity for valuable deductions. Virchow has said: "Where light is not, the doctor will be found." Sir David Brewster: "That light is the life-blood of

nature." Heat has been named Nature's Nervous System. Pliny has written: "Enter sunlight, depart disease." Hippocrates has said: "Old people are much younger than their age in summer and double their age in winter."

Just here I would tersely note an applicable observation. In the Eastern State Penitentiary of Pennsylvania the average population has been about one thousand. This prison has a separate cellular system. Each individual convict, after first entering his cell, practically never leaves it until the end of his sentence—an average period of over two and one-half years. The cells for fifty years were very poorly lighted, having only a narrow slot-like window in the ceiling. The solid doors were kept constantly closed, good even temperature and ventilation were maintained; the latter by ventilators at the floors of the cells and the suction process through the corridor into which the ventilators opened. Reliable analyses of the air were made which showed it to be of good quality and the same in the cells as in the corridors. For fifty years over 60 per cent. of deaths occurring were from lung tuberculosis. At the end of that period the light into the corridors was largely increased, the cell windows greatly enlarged, and all cell doors kept constantly open. All tubercular, markedly anæmic and strumous convicts were given one hour's daily sun-bath in the large open yards between the corridors. The convict clothing is very light, undyed and of open texture, admitting large volumes of light to the skin. For the ten years following this change the deaths from phthisis were reduced to less than one-third the previous record, and the total deaths from all causes to less than one-half.

The racial characteristics of those peoples whose nude bodies are exposed to light from infancy are: universally vigorous, well-developed bodies, and great resistance to injurious effects of climatic changes; also, the absence of physical deformity, so frequently of tubercular origin. As observed in von Ziemssen's *System of Therapeutics* (volume on *Climatology*), "New arrivals in regions or countries very deficient in light show depression of spirits and failure of mental energy, anæmia, loss

of appetite, gastric disturbances, turbid urine, and a species of nervous tire and unrest, with a condition akin to homesickness. These symptoms last long—many never acclimating. The development of a peculiar intermittent type of fever has been noticed."

Which are the rays of light that are bactericidal is not proved. In this connection the blue-light agitation of General Pleasonton, some twenty-five years ago, and the studies of the wonders of the x-rays, of recent discovery, are noted.

Tubercle bacilli inhaled, lodged, and nurtured in the lungs show a more virulent activity than when their abode is in the skin or external glands. The latter parts receive blood and fluids that have just been exposed to light in greatly increased volume over that penetrating to the lung. Nothing in medicine or surgery controls tuberculosis of the peritoneum so effectually as exposing this membrane to the action of air and sunlight—a fact accidentally discovered.

The pigment deposit called "tan," which is caused by the sun's rays, may perform a function in man analogous to chlorophyll in vegetable life. The susceptibility to tan of those parts exposed in nudity, as the hands and face, in those suffering from Addison's disease, glandular and other forms of tuberculosis, if they be subjected to the sun's light, is most noticeable. As nature's efforts are all toward cure, the reason for this phenomenon should be correctly understood.

The power of light to determine chemical reaction is unquestionably shown everywhere throughout nature. It is well illustrated in photographic work, and in the care that must be taken to exclude it in order to preserve successfully many chemicals and drugs. This suggests the thought of the deprivation of light's action on the blood being a partial causative influence in the increased percentage of rickety, soft-boned negro children reared in their miserably lighted courtway city dwellings. It is stated that the more highly vitalized tissues degenerate into much lower grades in the absence of light. Advantage of this fact is taken by poultry-men in confining fowls which are more muscular and less fat than is desirable in totally dark

coops for some weeks before they are killed, in order that their flesh may soften.

Tubercular disease is very much less prevalent among the outdoor dwellers than among those living in artificially lighted rooms and other ill-lighted places indoors, no matter how well ventilated and heated. It has been suggested that the establishment of pulmonary tuberculosis is dependent on the presence within the lungs of feebly vitalized, loosely-coherent tissues, which represent the lack of perfect balance between the upbuilding and breaking-down characteristics of normal tissue metamorphosis. Exposing the skin of such subjects to the influence of copious sun-baths may prove an efficient assistance in adjusting such lack of balance, and by such adjustment eradicating the possibility of the formation of such low-grade tissue. The time required for the entire blood of the body to pass through the capillary cutaneous circulation of the face, neck, and hands, the parts always uncovered, is not known; but, doubtless, from what we know of the circulation of the blood, it is but a short time. The importance of sunlight in the successful treatment of tubercular subjects is becoming more and more generally recognized. Many recent writers among our best observers place it as of scarcely less importance than air and altitude. Even though houses or sanitaria be thoroughly ventilated with outside air, tubercular patients must be in the fullest unshaded outside light in order to secure the best results.

In the field of dermatology the use of light as a therapeutic agent gives promise of great value. I have known a long-standing case of eczema universalis permanently cured by the sufferer exposing himself, nude, to an hour's sun-bath under a large window on all sunny days during July and August. All other conditions remained the same; all previous treatment had totally failed. The result must be accredited either to the action of light or to auto-suggestion.

The treatment of neurasthenia and its more advanced expression, melancholia, together with many other nervous maladies, has become largely the study and correct application of

the best methods of nutrition. In these subjects blood impoverishment in corpuscular value, hæmoglobin, and in volume, is the constant rule. The skin is emaciated and without tone or power successfully to resist the baneful effects of exterior impressions, like climate changes and draughts. As noted, similar symptoms result from environment under insufficient sunlight, which fact at once suggests the application of copious body sun-baths as a part of the treatment promising valuable results Suggestive therapeutics, as at least the handmaid of other means and methods, now seems of proved value. The use of sunlight as a means to an end under this heading should prove of service.

The absolute increase of light at the seashore and in mountain altitudes, as compared with other localities, is doubtless an important factor in restoring health. Observers have stated that light is about eight thousand times as intense at the seaside, and little less at high mountain tops, as in the average dwelling-room of city homes. This is as much light in five minutes in either of the before-mentioned localities as obtains in an entire day in the ordinary city dwelling. The thinnest and most feebly developed skin of all animals, birds, and fish, is found on those parts of their bodies least exposed to light. Lazy nature takes advantage of man's artifice to secure temporary comfort in modifying her processes of evolution. The more uninterruptedly man supplants by use of clothing the

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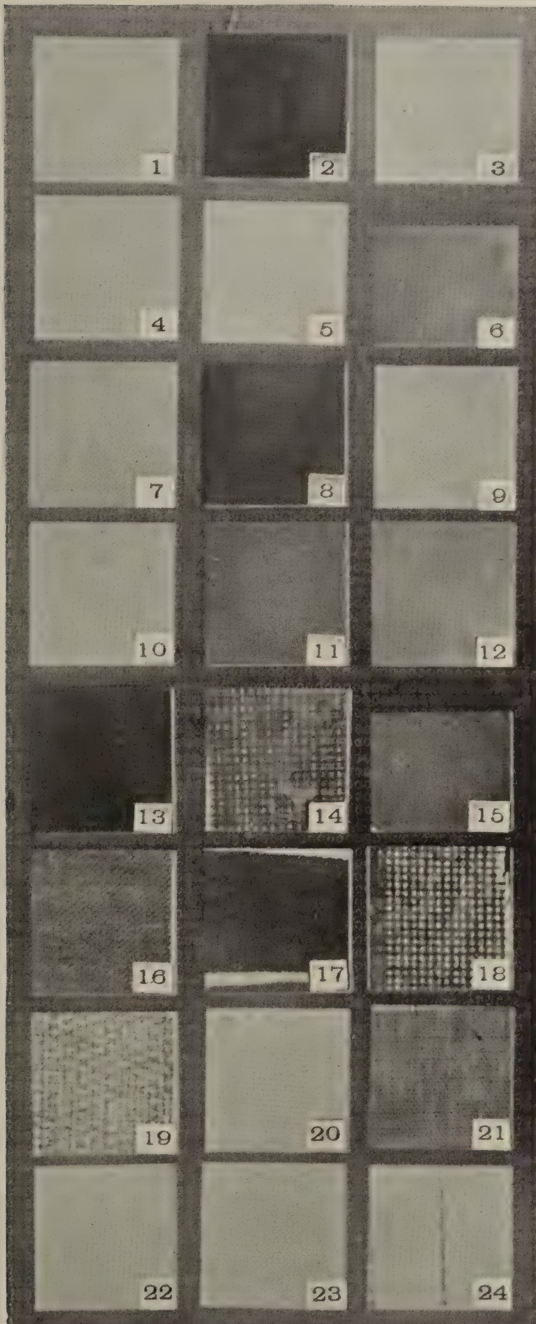
DESCRIPTION OF PLATE.

EFFECT OF SUN'S RAYS ON SENSITIZED PAPER AFTER PASSING THROUGH THE FOLLOWING MEDIA. 30 MINUTES' EXPOSURE.

1. Checked red and white silk used for ladies' shirt waists. 2 Fine black grosgrain silk. 3. Fine white flannel used for children's underwear. 4. White muslin, good quality. 5. White and red lawn. 6. Blue serge for suiting. 7. White silk-cotton back. 8. Black serge for suiting. 9. Dark blue crêpe. 10. Brown and white woollen cloth for men's winter suiting. 11. Black woollen cloth, loosely woven, for men's winter suiting. 12. Heavy linen crash for men's suiting. 13. Light-brown cloth, medium weight, for men's suiting. 14. Very light weight small, light, and dark-blue check for men's summer suiting. 15. Dark-brown and black woollen cloth for men's winter suiting. 16. Blue serge, light weight, for summer suiting. 17. Black serge, light weight. 18. Thin, open woven, basket cloth, light colored, for men's suiting. 19. Black grenadine, woven very open, for summer dress-goods. 20. White challe for women's summer dress-goods. 21. White linen duck, fine quality, close woven. 22. Light weight blue cashmere, women's dress-goods. 23. Thin white flannel. 24. Ladies' white striped dress-goods.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functions of the skin, the more feebly and imperfectly will the skin be developed.

Enough points have been touched on, but I would yet ask attention to the extent of light-penetration to the skin through the various kinds of clothing usually investing the human body. As a demonstration of this, I have placed between the sun's rays and pieces of sensitized photographic paper small pieces of various textures used as clothing, and have noted on each the result after thirty minutes' exposure. By these photographic exhibits it is seen to what degree the dye of clothing controls the permeability of light to the skin, the thickness of the clothing not being nearly so important a factor as might be supposed. This may explain why some neurologists find great advantage in having their patients carefully eschew all dyed underclothing, and why they favor all other clothing being of a light color.

I shall make similar studies with the x-rays.

For further consideration are left inquiries as to the effect of skin-covering on the development or enfeeblement of the skin, the transmission of heat, and the control of the functions of the skin in health and disease. Any one possessed of data bearing on any of the many phases of this subject of skin-covering and nudity who will supply the same to the author will be greatly thanked and will have due credit given him for such assistance in elucidating this subject in as great detail as may be possible.

DISCUSSION.

Dr. Daland: I am extremely interested in the paper last read. Its importance, I think, is clear to each of us, although we have had great difficulty in understanding precisely how it was brought about. I believe most of us feel that the subject of light is exceedingly complicated, and carries with it a great many influences that we have been unable to define, many of which are probably quite as important as those of the x-ray. I was strongly impressed with the health report of the prisoners. A reduction of 100 to 33 per cent is a remarkable result. Of course, in that category we must remember

there were elements other than light. Not only was additional light given the prisoners, but permission to exercise within certain limits, so that we cannot justly ascribe all the benefit to light alone.

It has also been suggested to me, while the author was reading his paper, that perhaps the long dark nights of the northern regions, more particularly Iceland, might possibly explain the extraordinary and rapid spread of tuberculosis which is now developing there. About five years ago a certain number of cases were imported from Denmark, and they have about doubled each succeeding year. With the darkness extending over so many days and weeks, in conjunction with the dampness, we can understand how rapid is the spread of phthisis in such a locality.

Personally I am very susceptible to what may be called absence of light. It seems to me that a depression comes over one in the ordinarily dark, somewhat clouded houses that are quite common in certain parts of the city of Philadelphia, and I am perfectly certain that the working power of men living in those houses must be materially reduced.

I am very glad that Dr. Robinson has interested himself in this subject, and I trust he will carry it further and give us additional well-ascertained facts at our next meeting.

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D indicates remarks in discussion of papers.